

THE CONDOR

A Magazine of Western
Ornithology



Volume 43

March-April, 1941

Number 2



COOPER ORNITHOLOGICAL CLUB

THE CONDOR

A Magazine of Western Ornithology

Published Bi-monthly by the Cooper Ornithological Club

Entered as second-class matter May 15, 1925, at the post-office at Berkeley, California,
under Act of Congress of February 28, 1925, Section 412, paragraph 4.

Issued from the Office of THE CONDOR, Museum of Vertebrate Zoology, Berkeley, California.

SUBSCRIPTION RATES

Three Dollars per Year in the United States, payable in advance.

Fifty Cents the single copy.

Three Dollars and Twenty-five Cents per Year in all other countries in the International Postal Union.

COOPER ORNITHOLOGICAL CLUB

Dues are payable in advance on January first for the calendar year: Three Dollars per year for members residing in the United States; Three Dollars and Twenty-five Cents in all other countries. Members whose dues are paid receive THE CONDOR without additional charge.

The Life Membership fee is Seventy-five Dollars. No additional dues are required, and the money is invested and the interest only is used for Club publications. Life Members receive The Condor without additional charge.

Send manuscripts for publication to the Editor, ALDEN H. MILLER, Museum of Vertebrate Zoology, Berkeley, California, or to the Associate Editor, JEAN M. LINSDALE, same address.

Send dues and subscriptions to JOHN McB. ROBERTSON, Associate Business Manager, Buena Park, California; orders for back numbers of THE CONDOR and the PACIFIC COAST AVIFAUNA series to W. LEE CHAMBERS, Business Manager, 2068 Escarpa Drive, Eagle Rock, California.

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BEHAVIOR OF THE BEWICK WREN

By EDWIN V. MILLER

This study of the Bewick Wren (*Thryomanes bewickii*) was begun in the spring of 1938 at the University of California, Berkeley. On the University campus, Strawberry Canyon, to which I have frequently referred in this paper, was the site of most of my observations. Besides the subspecies *spilurus*, which is found there, I have made a few observations on six other subspecies in western North America. This information has proved of value in determining the importance to be placed upon data chiefly obtained from a single subspecies. My method was almost entirely that of extended observation in one locality. A few wrens were collected to verify the identification of sex based upon behavior and to look for parasites. One of the greatest difficulties encountered was the lack of opportunity to observe the wrens in the latter part of the breeding period.

I wish to express my appreciation to Dr. Alden H. Miller for his advice to me in the course of this study. The late Mr. E. I. Dyer in 1938 kindly invited me to observe wrens on his premises and gave me much useful information.

Habitat.—Birds of the eastern race, *T. b. bewickii*, are apparently more domestic than their western relatives. In Alabama, A. H. Howell (1924:332), and in Illinois, Baird, Brewer and Ridgway (1874:146) found *bewickii* occurring commonly around outbuildings near brushy or wooded places. Wrens of the western races occur in brushy areas, but in greater numbers away from human habitations.

A few of my observations on several subspecies in western North America will give a picture of the habitat in this part of the species' range. On March 20, 1940, *T. b. cryptus* was seen in the Chisos Mountains of the Big Bend region in southwestern Texas. The habitat here consisted of mixed brush, cacti, and small oaks. Next they were watched at a point thirty-eight miles south of Nuevo Laredo in Nuevo León, Mexico. The country here was covered with a heavy growth of prickly pear (*Opuntia*) and other cacti and much brush composed of several species. Associated birds were the Verdin, Desert Sparrow, and Mockingbird. Near Charco Escondido, Tamaulipas, *cryptus* was common in a habitat of large mesquites. Birds such as the Pyrrhuloxia, Cardinal, White-eyed Vireo and Mourning Dove also were found here. On April 15 at Chipinque, Nuevo León, at 4000 feet, the wrens' habitat consisted of large oaks, pines and other trees, with a thick undergrowth of brush; in the same habitat were Whip-poor-wills and Couch Jays.

On April 21 I saw a few wrens of the subspecies *T. b. murinus* at an altitude of 5700 feet near Puente Tasquillo, Hidalgo. The habitat included numerous kinds of large cacti (organ and candelabrum), mesquite and other brush. At the Piramides de San Juan Teotihuacán, Mexico, *murinus* occurred in pepper trees and prickly pear cactus. On April 24 I visited Parque Chapultepec, Mexico City. The habitat here consisted chiefly of large trees (*Populus*, locust, *Eucalyptus*, *Pinus*, *Cupressus*, and others), in some places with thick underbrush; *T. b. murinus* was common here and associated with the Inca Dove and Broad-billed Hummingbird.

I was able to observe the subspecies *percnus* in several localities. On May 11, 1940, near the southeastern shore of Lago Chapala, Jalisco, I found this race in a habitat of dry, sparse brush and prickly pear cactus. On May 12 at San Juan de Los Lagos,

Jalisco, it was seen in thorny brush along with Cactus Wrens and Curve-billed Thrashers. On May 19 near Hacienda la Parada, San Luis Potosí, I found *percnus* in a habitat of maguey (century plant), brush, cholla, prickly pear and other cacti. Here also were the Lucifer Hummingbird and Cactus Woodpecker. On May 26 near Lulu, Zacatecas, a few *percnus* were collected in a habitat of small mesquite, creosote bush, cholla, prickly pear and much brush, where Harris Hawks and Scaled Quail were common.

On March 14, 1940, near Nogales, Arizona, *eremophilus* was found in mesquites, elderberry and dead brush along with Gila Woodpeckers, Canyon Towhees and Palmer Thrashers. On March 15 I noted *eremophilus* in the Huachuca mountains of Arizona in pines, junipers and oaks, with such birds as the Bridled Titmouse and Arizona Junco.

The habitat of *T. b. spilurus* may be considered in some detail. This subspecies occurs along the coast of California from San Francisco Bay south to Santa Cruz County. This region consists chiefly of low chaparral-covered hills, and it is in such cover that Bewick Wrens are found in greatest numbers. Strawberry Canyon on the University campus, in Berkeley and Oakland, is about a mile long by one-quarter mile wide, faces westward, and ranges in altitude from 400 feet to 1800 feet. Most of the habitats on the south-facing slope (eucalyptus groves and grasslands) are not used by Bewick Wrens, although there is some chaparral in the upper canyon on this slope.

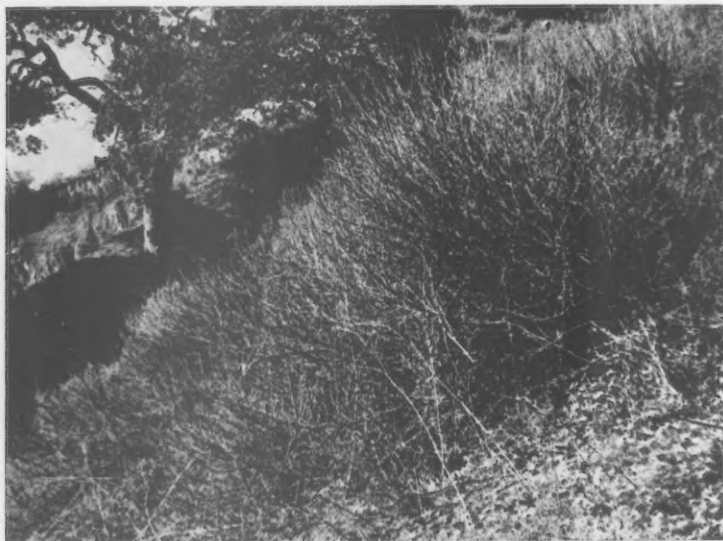


Fig. 25. Habitat of *Thryomanes bewickii spilurus* in poison oak (*Rhus diversiloba*); Strawberry Canyon, University of California campus, January 23, 1938.

On the north-facing slope the wrens are common, being found in chaparral, mixed brush and oak, and in pure stands of Monterey cypress and Douglas fir, without underbrush. In the chaparral association, baccharis is the dominant plant, forming dense stands of four to six feet in height. In the mixed brush and oak region the height of the plant cover is anywhere from one to thirty or forty feet. Oaks and laurels occur scatteringly, with low brush and vines underneath them. Willows and poison oak are more common

in the bottoms of gulches. Madroño grows in nearly pure stands. Introduced conifers (species of *Sequoia*, *Abies*, *Cupressus*, *Pseudotsuga*, *Pinus*, *Picea*, *Libocedrus* and *Thuja*) are present, but with the exception of Monterey cypress and Douglas fir, are not invaded by *spilurus*. The outstanding characteristic of the habitat is the great thickness of the plant cover. This is one of the chief factors influencing the occurrence and abundance of Bewick Wrens. Here in Strawberry Canyon, where the brush is about as high and thick as I have found it in any place where Bewick Wrens occur, these birds are most abundant. The particular species of plants concerned are also of a good deal of importance, for some plants in Strawberry Canyon, notably redwood, eucalyptus and laurel, are not inhabited by the wrens, apparently because of the lack of invertebrates living on these trees. The density of foliage and growth of these trees is as great as that of other plants here, so that they should be satisfactory from a physical point of view. The only assumption I can make is that they do not furnish food; other insectivorous birds also shun these trees in this region. There are few places so silent and free from vertebrate life as a dense redwood grove.

Opinions differ with regard to the relation of Bewick Wrens to the dense plant growth of their habitat. Grinnell, Dixon, and Linsdale (1930:331-332) and Swarth (1916:56) think that the brush of the habitat supplies protection and shelter. I think that the presence of these wrens in thick brush is more closely related to their foraging habits. They forage chiefly on limbs and branches, which are nowhere so abundant as in a habitat of dense trees or bushes. Furthermore, Bewick Wrens often venture into relatively open places to forage over the trunks of trees, which they would not do were they solely concerned with shelter. The two factors, shelter and food, are probably both of importance in habitat selection by the wrens.

There are but few features of habitat common to all the races of Bewick Wrens. Thick plant growth of a kind that will furnish the proper insect food seems to be the chief requisite. The kinds of plants in one part of the range of the species may be totally different from those in another part. The wrens may be found in trees more than one hundred feet high or in brush not more than three feet high. In the Upper Sonoran Life-zone they are most abundant where the plant growth is thickest. They are particularly noted for their preference for mixed brush. There seems to be no difficulty in finding nesting sites, even though suitable cavities appear to be scarce in some areas that are occupied.

Animal relations.—The relations of the Bewick Wren to other animals are, with a few exceptions, chiefly neutral. There are many species of mammals and reptiles that occur in the habitats of the wrens, but there is no direct evidence at present that they are harmful to this species. Nevertheless, I have found wrens' nests destroyed, so that there certainly are some offenders. May (1935:97) lists wrens in general as a part of the food of the Sharp-shinned Hawk. I have heard *spilurus* react by giving *pee* notes as these hawks flew overhead, but I have not seen the hawks show any interest in the wrens. The latter are perhaps too well sheltered by the thick brush in which they live. I have seen Bewick Wrens chase such birds as the Wren-tit, Spotted Towhee and Oregon Junco and have seen the wrens chased by Wren-tits and Song Sparrows. Such behavior is rare, however, and the chase is only a short dart with no actual contact between the birds. In some parts of their range, Bewick Wrens do come into conflict with other birds, especially in the breeding season. E. I. Dyer (MS) reports that in 1933 at his home in Piedmont, California, a Plain Titmouse dispossessed a pair of wrens from a bird house. The wrens selected another house nearby. Roads (1929:103) says that he saw a House Wren dart at a singing Bewick Wren, striking the latter on the back. On another occasion a Bewick Wren drove a nest-building House Wren off

the latter's premises. Eifrig (1933:65) states that in Maryland, House Wrens are increasing and Bewick Wrens decreasing. Brooks (1934:244) found the same situation in West Virginia. In 1914 there were six pairs of Bewick Wrens on his premises; in 1933 one pair was present nearby. There were three pairs in 1927, three in 1928, one in 1929 and one in 1930, and none thereafter (to 1934). In some places Bewick Wrens disappeared except in migration. Brooks once saw House Wrens use force to dispossess Bewick Wrens. Sutton (1930:15) states that in West Virginia the nesting territories of the Carolina and Bewick wrens overlap more than those of the House and Bewick wrens. The House Wren and Carolina Wren do not bother one another in the same region, but the Bewick Wren comes into conflict with both of the former. Sutton says the Bewick Wren usually retreats when disturbed by the House Wren. According to Grinnell and Storer (1924:555) the four species of wrens found in the Yosemite region, California, do not meet in serious competition. The Canyon Wren is found on rocky canyon walls, the Rock Wren about earth bluffs and rocky outcrops, the House Wren in oak trees, and the Bewick Wren in mixed growths. In the winter I found *T. b. marinensis* and Western Winter Wrens in the same habitat, but there was no friction between them. The Winter Wrens foraged mostly on or within a foot of the ground, while *marinensis* was higher up in the brush.

Foraging.—As is well shown by Beal's study (1907:57) of its food, the Bewick Wren is chiefly a gleaner of small insects. In this process, short quick hops are made from branch to branch and an insect or two is picked from the bark or leaves every few seconds. Pecks often average one per second. On small branches and twigs the birds sometimes cling to lower sides in an upside-down position. The activity rate is high, the bird seldom stopping more than a second or two at any one place unless the influence of unusual factors intervenes. Now and then (commonly less than every half hour) a wren ceases foraging to fly a few feet to a new location. These flights are generally from five to forty feet in length, depending upon the habitat, the wren, and other factors. Sometimes they occur when a wren approaches the edge of its territory, whereupon the bird turns back. At other times the reaching of the edge of a favorable forage ground may cause a flight. Sometimes, however, purpose in such changes of forage sites cannot be seen.

The characteristic area of foraging is on the lower, larger trunks and branches of weeds, brush and trees. The plants on which foraging takes place are almost any of those found in the bird's habitat. The thick vegetation in which the wren forages contributes greatly to the efficiency of the process, for the branches are so close together that only short hops and few flights are necessary. Not uncommonly a wren will hop on the ground and pick food from it or turn over a leaf with its bill, but there is never any scratching. Sometimes the bill is wiped vigorously; the bird draws it back and forth against twigs. This occurred on one occasion after a wren pecked at and finally swallowed a naked caterpillar larva about three-quarters of an inch long. The bill was wiped for two minutes, being drawn back and forth about one hundred times. Bewick Wrens are not as highly specialized in the use of their bills as are some birds. Warblers, for example, use their bills chiefly for plucking insects off leaves and twigs. A Bewick Wren's bill is used in this way also, but in addition, due to its greater length, it can be used to dig insects from cracks, to flip over leaves and to manipulate large larvae.

Different methods of foraging are used, depending upon the nature of the vegetation. In low tangled mats of brush the bird moves about out of sight among the lower branches. In larger, more open brush the wren usually begins at the base of the trunks and hops vertically upward, often working in a spiral fashion around the bush. Upon reaching the branching twigs of a bush or tree, a circuitous route around or through

the inner portions is followed. If the brush is too thick to enter readily, or if the bushes are not close together, the bird hops around the bases on the ground and picks insects from the bark. Trunks of trees a foot or so in diameter are foraged over rather than the twigs. In doing this the wren clings to the bark, creeper style, and moves upward by short hops as it goes. At times insects slightly embedded in the bark are removed by a rapid series of pecks resembling those of a woodpecker. I have heard these pecks at a distance of thirty feet. Because of the slenderness of the wren's bill it is doubtful if much bark is removed. When the bird hops up the vertical trunk of a tree, the tail is depressed as though for support, although it seems actually not to touch the surface of the tree. Infrequently, a wren will flutter up under an overhanging limb and pick an insect off while flying. This may also be done in a quick dash without fluttering.

Factors modifying foraging are probably numerous. As mentioned above, different approaches are used for different floral types. Thus, the kind of plants present in the habitat, their relative amounts, and their distribution influence foraging procedure. For example, in low relatively sparse vegetation the bird hops on the ground around the bases of bushes, whereas in moderately thick brush this behavior is not often seen. In windy or rainy weather the wrens keep more to the interior of dense brush. The structure and instincts of the bird influence forage behavior more than can readily be determined. I frequently saw mated birds foraging in early spring, the male up in trees, while the female kept a foot or two off the ground. The female followed the course set by the male and was even fed by him. This separation of forage locations for mated birds occurs in early spring when wrens first mate. After nest building foraging occurs separately or together. If together, there is no separation of the foraging locations. Both wrens forage on all levels. It is possible that the separate foraging location procedure may have been developed because of the smaller amount of food present in the territory early in the season. Later on in the spring there is plenty of food and no need for the sexes to forage in separate locations. Interestingly enough, similar behavior occurs in the Saint Kilda Wren (*Troglodytes t. hirtensis*), where the two sexes have foraging territories that are entirely separate (Harrison and Buchan, 1934:139).

Another factor that influences foraging is singing. This may take up half the male's time in early spring. Unsocial behavior such as meetings between males on territorial boundaries may interrupt foraging for periods up to about one-half hour. Other animals, hawks for example, may cause a retreat into thicker brush and a cessation of activity. Lastly, unusual supplies of food in the habitat will cause a change in the type and location of foraging.

Roosts.—I have failed to find the roosts of Bewick Wrens. At about sunset they are quiet and difficult to find in thick brush; moreover, when a bird is followed in the evening it is much more likely to stop calling altogether than at other hours of the day, and when this happens, it is practically impossible to find the bird. Several times I was able to follow wrens a short ways after the sun had set; light intensity was so low under the trees that I could hardly see the birds, but they either entered a dense brush tract or else their *pee* calls ceased, leaving me baffled. E. I. Dyer (MS, 1933) records the following incident from Piedmont, California: "Late one afternoon at the beginning of winter a scratching was heard about the eaves of the shack. Investigation showed that it was a Vigors Wren looking for shelter. A house was made as quickly as possible and put up under the eaves and every night thereafter until nesting time, at least one wren occupied the house, only to be dispossessed by the Plain Titmouse in spring."

Bathing.—I have observed bathing, or more correctly dusting, of Bewick Wrens but twice. The whole of my notebook account of the first incident of this kind is as

follows: "April 6, 1937. Canyon Road, Strawberry Canyon, U.C., where the road crossed the creek. 6:35 p.m. Cool, clear, and still. Heard a *whit-pee-pee-pee* sound from the brush. A wren flew across the road with a jerky flight and scooted into the brush about 6" off the ground. He (?) kept on making the noise. In a moment he appeared, flashed out into the middle of the road, for several seconds squatted low, jerking his body in semicircles, first one way, then another. Then he squatted still lower and ruffled his feathers in the dust on the road, which was extremely little and damp besides. Then he again fluttered into the brush still making the noise, and in a moment appeared and repeated the dusting procedure. Again into the bushes." I saw this behavior a second time on April 17, 1938. At 9:10 a.m. a female was foraging on the ground along a trail on the south side of Strawberry Canyon. As she crossed the trail, she squatted in the dust, jerked her body back and forth and ruffled her feathers in the same manner as noted above. This continued for about a minute, whereupon she resumed her foraging. The trail was only slightly dusty. E. I. Dyer (MS, 1934) states that at his home in Piedmont, California, "The Vigors Wren . . . is a persistent duster, sometimes dusting many minutes at a time. Just now (August 8, 1934) one was seen showing signs of trying to bathe in a vessel which is kept under a hydrant, but the water was beyond his reach. It was then filled with water and the wren returned at once and had a thorough bath."

Preening.—On several occasions I have observed the wrens preening themselves. In fifty hours of observation at various times of the day I saw preening occur but four times, and this occupied only a few minutes of the time of three different wrens. In preening a wren usually perches in the sunlight on some small twig, grasps feathers near their bases and runs its bill down them with a wiggling motion. Once a wren reached back several times and appeared to be getting oil from the preen gland. There seems to be no regular order in which feather tracts are preened—rather a bird skips from place to place, fixing feathers here and there at random.

Songs and call notes.—Among Bewick Wrens the males are the only individuals that sing. The female has some call notes similar to the male's, but nothing resembling his song. I first noted this when I saw a pair of wrens together. One of the birds did all the singing. Later, while the female was on the nest laying, I found that the male was the one that sang. I also collected about ten wrens, noting their behavior first and sexing them to test my identifications, which I found were correct.

The different vocal notes of the male and female are probably the characters that the wrens themselves use to recognize sex among their own kind, since the plumage of the two sexes is the same. The least that can be said is that a male wren responds differently to the vocal notes of other males than he does to those of a female; this would seem to constitute recognition.

In studying the songs of the Bewick Wren I have written down a large number in my notes in syllable form. All songs are characterized by pronounced and vigorous rhythm. Most of the songs contain a trill, which is either simple or complex. Of the simple trills there are two main kinds. The first is rapid and higher pitched; four varieties of it are a long *trrrrrrrrr*, a short *churr*, a sibilant *sperr*, and a harsh *skerr*. These are pitched differently and the last three occur not only in the song but also separately as "call notes." The *trrrrrrrrr* is higher pitched and not harsh as are the other three. The second simple trill is slow, loose and low pitched and has but one expression—*pdddd*. This is a true part of the song and is not given singly. The more complex type of trill is a rolling, repeated *wrrr-wrrr-wrrr*. It is not given singly. This trill, the *pdddd* and the *trrrrrrrrr* types more commonly occur at the end of the song when they are present, although not always. The *trrrrrrrrr* trill is the most common of

all and occurs very frequently. It is almost invariably present in the songs of *cryptus*, *eremophilus*, and *percnus*. Among *spilurus* and *marinensis* it occurs in about one-half the songs.

A not uncommon component of the song is a buzzy *bzzz*, *tzzz*, or *spzzz* note. This occurs fairly commonly by itself. A great many other notes occur in the songs. I have these recorded in four different pitches with *ee* designating the highest, then *i*, *e*, and lastly *oo*, the lowest. The notes *ee*, though recorded so, are not necessarily all on the same pitch. They vary more in small modifications than any others. They may have a simple sibilant beginning such as in *see*, *bzee*, *spee*, or *tswee*. They may have other beginnings such as in *tee*, *chee*, *twee*, *wee*, or *wee*, or they may be modified at beginning and end both as in *weep*, *weer*, *peew* and *whees*. Notes of the next pitch down occur in sibilant form as *spit*, *tsip* and *sit*, and otherwise as *quit*, *pit* and *whit*. The notes of lower pitches are less common. *Wher*, *quer* and *ter* are the only notes of that particular region of the scale, whereas those of the lowest pitch are found with sibilants such as *soo* or *tsu* and *twoo* and *too*. These notes are all short and sharply given. Along with the trills they occur in many combinations of from two to seven notes and (or) trills. If there are but two parts to a song, one is sure to be a trill of the true song type. Within the longer songs the same note commonly is given from two to four times in succession. This does not apply to the trills, where the same ones are not given successively. Some examples of songs are: short-*see*, *trrrrrrrrr*, long-*spee*, *churr*, *tsip-tsip-tsip-tsip*, and *see*, *spzz-spzz*, *trrrrrrr*. The last song was given by a male *spilurus* in the period when he and his mate were feeding their young. His are the only songs I have recorded with buzzing notes in them, although I have often heard these notes given singly. This wren sang four different songs in one hour.

The songs of some of the subspecies differ from those of other subspecies to a recognizable extent. Dawson (1923:670) notes that the western races have developed greater versatility in singing than the eastern races. My own observations agree with his. Songs of *spilurus* average about four or five notes apiece. Songs of four subspecies that I heard in Mexico were more than ninety per cent of three notes only. The separate notes were the same, as far as I could tell, as those of the races in California. The common song that I heard nearly everywhere on the southwestern deserts was *too-wee-trrrrrrr*. In one small locality, at Lulu, Zacatecas, nearly all the wrens put the *too-wee* notes at the end of the trill as well as at the beginning. This shows that small, local, possibly inheritable variations have developed.

Bewick Wrens often choose conspicuous perches for singing, especially in the spring just before they are mated. Wrens in Strawberry Canyon generally perch on the outer small twigs near the top of a tree or bush. In North Carolina, Brewster (1886:176) reported the males singing from ridgepoles and gable ends of buildings in towns. I once saw a wren singing from four different perches in two minutes. Most of the wrens I have observed sing in about the following position: feet spread wide apart, tail horizontal, bill tilted slightly upward, wing tips a little beyond the body and a little below the level of the base of the tail. The throat and tail vibrate during the song, and there is hardly any movement between songs. Most authors speak of the tail hanging down in the manner of a thrasher, but I have not seen them sing in this posture more than with the tail horizontal, and I have even seen the tail erect during singing. One wren, which sang *spee*, *churr*, *tsip-tsip-tsip-tsip*, opened his bill wide for the first note, closed it some for the second and opened and closed it for each succeeding note. The song lasted three seconds, the first note being one second long. David G. Nichols drew my attention to the fact that birds are often pictured singing with their tongues in full view, whereas this seldom or never occurs. In Dawson's "Birds of California" (1923:

672) is a drawing of a Bewick Wren showing the tongue exposed during singing. I have never seen these wrens sing in this way.

Of twenty-six wrens that I timed, the songs were given from one to eighteen per minute with an average of ten per minute. Each of these birds sang from one to five minutes. Some of them produced almost constant sound by giving *swee* notes in between the songs. The songs were given regularly and at much higher rates in the spring. On rainy days the rates were slower, and fewer songs were given. Wrens often sing in the spring while foraging; these songs seem to burst from their throats in spite of their attempts to devote their attention to foraging.

The songs seem to be of use in helping to maintain territories. In the early hours of the morning the wrens are especially active, and much singing is done. This sometimes occupies a half of a bird's time. Also at this time of day meetings of males on territorial boundaries are more frequent than in the afternoon. A natural chain of events probably occurs: the wrens awake hungry and move about foraging; several meetings of males take place; all this serves to refresh each bird's memory of its territorial limits; then hunger is appeased, activity slows down, and each bird remains farther away from its boundary lines; as a result there is much less singing.

Wrens in Strawberry Canyon sing from early spring until late autumn. In 1939 I heard one singing on September 9 and did not hear another until after the first winter rain. S. B. Benson (MS) records *spilurus* singing at Berkeley on December 6, 1930. Lloyd (1887:297) says that in western Texas *eremophilus* sings from early spring until fall, and Jewett and Gabrielson (1929:42) state that *calophonus* "... may be found in almost full song throughout the winter on bright days." Whether these are adults is unknown. Welter (1935:11-12) says of the Long-billed Marsh Wren that song ceases in August and only young birds sing thereafter.

Bewick Wrens have a varied repertoire of call notes. The sexes of Bewick Wrens can be identified on the basis of their call notes, although there are at least three notes that are the same in the two sexes. These are a nasal *pee*, a high, throaty *spa* and a buzzy *spzzz*. The male, however, gives a great many more of these calls than the female, who does not give them at all in the early spring. The calls peculiar to the male are sharp *pit* and *chit* notes; hissing *sew* and *see* notes; a peculiar *zzzz* that I heard but once; a twittering during nest building, heard but once; a grating *skuz-uz-uz-uz*; a harsh low *skeer*, heard but once; and light *ku-wee* notes. The male's *pit* and *chit* notes are given sharply in a short series commonly during territorial encounters and almost never elsewhere. His *sew* and *see* notes are variations of the same note at different times of the year. The *sew* note begins to be given in early spring and about nesting time changes gradually to a more intense and hissing *see*. It is used chiefly to fill in gaps between songs and in this way the male at times keeps up a continuous stream of sound. The *zzzz* note, which I heard but once, occurred while a wren was foraging and was probably a variation of some other note. The twittering notes occurred in a very unusual situation. I had removed a piece of bark from a tree to look into the nest cavity of a wren. When I replaced the bark, I did not leave enough room for the birds to get in again. The next morning when I returned they were trying to enter with nesting material without success. I enlarged the opening and both birds entered. When the male emerged he peered in all directions, hopped around the hole and gave the twittering notes. His behavior bore a curious resemblance to a human saying, "This is too much for me to understand." The male commonly gives the *skuz-uz-uz-uz-uz* notes at territorial encounters. The *skeer* note, which I heard but once, probably had no especial significance. The male employs the *pee*, *spa* and *spzzz* notes in territorial encounters, the latter two being almost confined to such behavior. The *pee* notes are the most common

of any in the male's vocabulary. They vary greatly in volume and in the rapidity in which they are given. They are given slowly and lightly while the male forages and probably serve both as a mild expression of territoriality and to keep the female aware of his location. Since the mates keep together a great deal in spite of the thick brush that they wander through, some method besides vision is necessary to help them find one another. The male also uses his territorial notes to attract attention to himself when intruders approach a nest with young. The male's *ku-wee* call was given when he searched for the female to feed her during the period of incubation.

The female employs *pee*, *spa* and *spzz* notes very rarely. She gives *spa* notes during nest building and *spa* and *spzzz* notes later in the breeding period. Since these are the territorial notes of the males, it is not surprising that the female does not use them earlier in the season. If she did, her own mate might mistake her for an intruding male. Later in the season his territorial reactions are much weaker and her uttering of these notes seems to make no difference to her mate. During the breeding season the female's common note is a *sker*, *sper* or *spaer*. It seems to be used to enable the male to know of her whereabouts. The female has *swee* or *ee* notes, which, given in rapid succession, induce the male to feed her. These are given during nest building and incubation. She has a loud, piercing *teerrrrr*, which she uses to call the male when she is ready for copulation. The three times that I heard this call the male came rapidly and copulation occurred. Just before copulation the female gives a high-pitched twittering warble. This behavior is similar to that of the Long-billed Marsh Wren, where the female gives a trill preceding copulation (Welter, 1935:13). During copulation the female gives a *tee-ee-ee-ee* call, which may be the same as her begging notes. It seems likely that the note which the female uses to call the male to her for copulation may have developed as a result of the dense brush where these wrens live. When the female is in "oestrus" and desires copulation, she has no way of seeing her mate and going to him to attract his attention as some birds do; this seems to be the reason for the development of the call.

Territory.—Although I did not band any Bewick Wrens, I was able by repeated observations in the same locality to discover something of their territorial behavior. In Strawberry Canyon, the wrens are found throughout the year, either singly or in pairs of mated birds. At all times of the year I was able to find both single birds and pairs. Lone wrens were common in the fall and winter, and even in the spring a few could always be found. Nearly all of these single individuals were males (as told from their singing, the females having no song). I rarely saw single females. Mated wrens nearly always keep so close to one another that if one is seen the other is almost certain to be discovered also. This apparent preponderance of males is partly explained by the fact that males are much easier to find, because of their frequent songs and calls, than are females. Yet, the considerable number of unmated males present in the spring indicates that the sex ratio is in their favor.

Male wrens show territorial reactions toward other males whenever they meet at any time of the year. Females show no territorial reactions toward males, and I have never seen a female encounter another of her own sex, so that I do not know what her behavior would be in such circumstances. From the facts that the female has no song, is quiet, and does not assist the male in the general defense of the territory, I think that she has no part in the maintenance of the territory. Yet she is cognizant of the male's territory, or at least does not venture out of it. Until nest-building time, she remains close to her mate continuously and probably learns the extent of the territory in this way. Males and mated pairs definitely have territories in the spring. In the fall and winter some appear to have territories, but many do not. These latter may be young birds of the year.

My evidence for the existence of territories is based on the following observations: 1. In the spring (January to May) of 1938 I made frequent observations on several wrens scattered over a small area in Strawberry Canyon. Day after day I found that a male or a pair of birds would be present on the same area where I had previously seen them. For several hours at a time I would keep track of a wren, which never ventured out of a certain area. Some of these areas remained the same for at least two months. I speak of the areas, since I could not tell if the birds were the same from day to day, although they probably were. The limits of these territories did not vary more than a few feet from day to day. 2. The males of these areas exhibited strong reactions toward other males adjacent to them. When two males happened to meet on a boundary, they would stop foraging, sing and give harsh vocal utterances, and

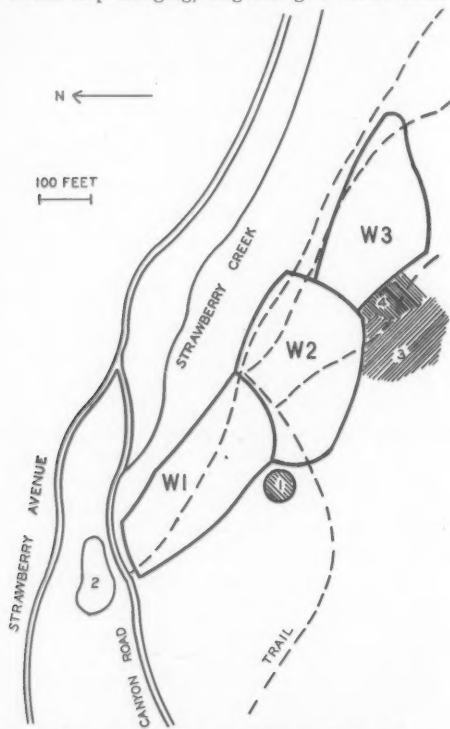


Fig. 26. Territories of three male Bewick Wrens in a small area in Strawberry Canyon, February 26, 1938. Small figures indicate the following: 1, large laurel tree; 2, Strawberry Pool; 3, redwood trees; 4, Madroño trees.

follow each other along the edge of their territories. Males would often stop foraging and hurry to their boundaries when they heard another male nearby. Males sang a great deal of their time and this singing occurred in all parts of their territories.

When I first began observations (January 16, 1938) on the lower north-facing slope of Strawberry Canyon I found no wrens, which may have been due to their customary

quietness at this time of the year. On January 20 I found a male which I called W2; on January 22, another male, W1; on February 20, a male, W3; and on March 2, a mate for W3. The territories of these wrens were approximately fifty yards wide by one hundred yards long and were arranged end to end around the side of the hill. By February 16 I had the boundaries of these territories mapped (see fig. 26); these all remained the same until March 11. On March 14, W2 was missing and his territory remained unoccupied throughout the rest of this breeding season. At the time W2 disappeared, a male, possibly W2 himself, appeared in a territory just below that which was vacated. Males on both sides of W2 had obtained mates by the time his territory was found vacant. If he merely moved to a new location, it may have been because of his failure to obtain a mate. The territory of W2 was occupied for seven weeks before it was deserted. The two pairs of wrens on either side of this area did not extend their territories into it after it was vacated, and no other wrens occupied this area in this season. This illustrates the fact that the wren population in this region is not large enough to fill the available habitat. A considerable area of what appears to be Bewick Wren habitat in Strawberry Canyon is untenanted by wrens.

In the above instances the males took up territories and the females appeared later, but it does not always happen this way. One day I found two birds that were mates that had moved in together on a territory, and Butler (1897:1117) says of the migrant Bewick Wrens in Indiana that individuals arrive about the middle of April, some birds being mated when they appear. E. I. Dyer (MS) observed a male wren about his premises nearly every day in the winter of 1933-1934, and on January 23 it appeared with a mate. It is probable that early spring is the common time of mating. Among the migratory subspecies, at least, territories cannot be preserved throughout the year. In *spilurus*, territories appear to exist in the winter. In several areas I found wrens present in the same locations for a month or more in the winter of 1939. I have seen other wrens, possibly young, in winter, which wandered beyond the possible limits of any territories. In the fall, wrens frequently show up in residential districts where they do not breed. A reason for doubting the existence of territories throughout the year is that singing of *spilurus* ceases entirely in the fall. Welter (1935:10) states that the Long-billed Marsh Wren has strict territory, but that during incubation, reactions are weaker and when the young leave the nest the territory is deserted. Parents and a brood of wrens under my observation also deserted their territory after the young left the nest.

Territorial conflicts, which in *spilurus* are no more than vocal battles, occur frequently along boundaries. On the boundary between the territories of W1 and W2 seven of these meetings took place during eleven hours of observation. When two males meet, each devotes most of his attention to singing and the uttering of harsh notes; the notes are basically of five kinds—long *bzzz* notes, short, sharp *pits*, series of rapidly repeated *pee* notes, harsh *spa* notes, and hissing *sew* notes. With the exception of the *pee* and *sew* notes, these are mostly used during territorial meetings. This is especially so in the breeding season. Singing and *pee* and *sew* notes appear to be used in the general maintenance of territory, being given frequently by males not engaged in territorial encounters. The duration of twenty meetings that I observed varied from a few minutes to a half hour. I never saw any males fight or invade a neighbor's territory. Males were generally from three to twenty feet distant from one another along their boundaries. After a few minutes of calling one wren would turn back and forage in his own territory and the other soon would follow suit. Wrens were very responsive to all the vocal notes of their own species, but I never saw a wren respond to the song of any other bird. Because the male and female are close together after mating, the differences in their call notes may prevent the male from mistaking the calls of his mate for those of another male.

There is a certain correlation of territorial boundaries with both kind and distribution of vegetation. Madroño and redwoods limited the upper boundaries of W2's territory. On the east a few conspicuous elderberry bushes and an open space likewise were limiting factors. The northern boundary was marked by a trail and also by a sudden steepness in the declivity of the hillside. On the west conspicuous oaks formed a line. The features of the habitat possibly involved in boundary limits are: man-made features (trails); topographic features (steepness); open spaces in the vegetation cover; lines or rows of trees or bushes; and certain types of dense growths wherein the wrens do not venture.

Bewick Wrens do not use posturing or conspicuous colors (they have none) as aids in the maintenance of territory as do Snow Buntings (Tinbergen, 1939) and English Robins (Lack, 1939). The lack of these aids may be the reason for the variety and harshness of the calls of these wrens. The low visibility in the habitat of the Bewick Wren may also explain this lack of posturing. The Long-billed Marsh Wren is the closest relative of the Bewick Wren for which I can find data concerning its territorial behavior. According to Welter (1935:8), males of this wren fluff out their feathers in addition to singing during territorial encounters.

Nesting sites.—Bewick Wren nests generally are placed in cavities in or within a few feet of the ground. This is partly because there usually are no nesting sites at high elevations within their habitat, which is often low brush, and also, at times of the year other than the nesting season these wrens live low down in the brush; they are in the *habit* of living near the ground. Dawson (1923:667) aptly describes the nest as "Indescribably varied in construction; in general, any available soft or pliable material to fill any available hole or cranny." Probably not just any "hole or cranny" will be selected; only those of a certain size and in the most secluded spots possible were used for the several that I have seen. E. I. Dyer (MS) placed a nest-box for wrens on top of a lath house in his garden. It remained there for two years, in which time the wrens about his premises nested in "a rock wall, a pile of boxes, [and] under a tile on the roof . . ." The third year Dyer moved the nest-box to the trunk of a Monterey pine and the wrens immediately occupied it, which indicated that the box probably was too exposed in the first situation. The wrens spend much time exploring cavities, where they seemingly are looking for nest sites and probably do not overlook any possibilities.

In Orange County, California, Dunn (1902:33) found *correctus* nesting only in "... crevices of rocky ledges, interstices between boulders, or in small caves." Where wood rats were common the wrens often selected a crevice too narrow for a rat to enter. Two nests of *spilurus* found by myself were in small natural cavities in the forest floor. Another was ten feet up in a rotted-out cavity in a live oak, and one was in the cavity in the top of a small stump three feet high. At the home of Mr. Dyer in Piedmont the wrens (*spilurus*) for several years nested in small bird houses suspended among trees from ten to fifteen feet above the ground.

The Bewick Wren, then, is restricted to relatively low cavities for nesting sites. The cavities are probably deep enough in most instances to hide the nest from view. One that I found extended horizontally about eighteen inches into the hillside and was six inches wide by four deep. The nest was placed at the back of the cavity.

Nests.—By far the greatest number of Bewick Wren nests are cup-shaped and open above, but according to Burns (1924:191) some have a domed form. A. B. Howell (1917:99), Taylor (1890:277) and E. I. Dyer (MS) mention one example each of a nest arched over with a side opening. Such nests are rare and may have been built thus to afford more protection. Probably an important factor is the kind of nest cavity selected. The arched-over nest of *leucophrys* found by Howell was in a dense patch

of cactus. The nest of *spilurus* found by Taylor was in a slender willow, next to the trunk. That found by Dyer was in a peculiar position among some timbers of a building. All three of these nests were not completely surrounded by walls as they usually are.



Fig. 27. Parent Bewick Wren bringing food to young in nest in hollow stump in Strawberry Canyon, June 19, 1940.

The kinds of materials used in the Bewick Wren's nests depend upon the locality; whatever is present of the right size and texture is used. A nest of *spilurus* that I found had a base of twigs of about one-eighth inch in diameter—the base being about six inches across and one inch deep. The cup was placed near the center of the base among the twigs and consisted mostly of fibers of the soap plant (*Chlorogalum pomeridianum*). The cup was about one-half inch thick and was lined with a thin layer of rabbit fur and a few soft feathers. Snake skins are sometimes found in the nests. A. H. Miller (MS) found two nests in the Los Angeles River bottom, Burbank, California, on April 7, 1923, both of which contained a piece of snake or lizard skin. One of these nests was "4' up in a 12" diam. stub near the top in a rotted out woodpecker hole." It was made of sticks, felted hair, fur and feathers, in addition to the piece of snake or lizard skin. The nests vary a great deal in size, probably because those nests placed in small cavities have little material making up the base.

Mating and nest-building activities.—Bewick Wrens commonly mate in the early spring, although some of them may have either remained mated throughout the winter or else become mated in this season. Simmons (1925:298) says that the wrens (*cryptus*) are seen in pairs "in February . . . searching for nesting sites; undecided for several weeks . . ." On April 8, Bailey (1923:55) noted a pair of wrens "exploring a crack in the underside of a live oak branch." I noticed similar exploratory tendencies in *spilurus* early in the spring. The nest-building instincts develop in unmated males as well as in mated pairs. On February 23, 1938, I saw a single male carry a stick for a few seconds. On February 26 I saw probably the same bird carry a stick for several minutes. This is the only nest-building behavior I have seen among unmated males. In this connection, Barrow (1912:670) reports that on May 5, L. J. Cole, at Grand Rapids, Michigan, saw a single bird carrying nesting materials through a small hole in a cigar box nailed to the inside of a shed. This male (it sang) built slowly until May 16, when a female appeared. A bluebird attacked them at this time and they disappeared.

Early in the season the building instincts are weak. E. I. Dyer (MS), on February 9, 1934, saw one of a pair of wrens come down from a tree with a piece of soap-root fiber. At the sight of a worm "he dropped to my hand releasing the fiber at the same time." Both sexes build the nest, although there are some statements to the contrary. These apparent exceptions probably occur because of the fact that both sexes do not always build at the same time. Wrens that I watched built but a single nest, but Simmons (1925:298) states that "*eremophilus*" sometimes commences as many as four nests a week. On March 3, 1934, E. I. Dyer (MS) saw a pair of wrens (*spilurus*) carrying feathers to one site, although later they apparently took another permanently. On April 5 he discovered that they had left the latter site and had young in a wren-house. In 1938 Dyer told me that he saw a nesting *spilurus* in five different nesting sites after building in another place had begun. Evidently the stimulus to find a nesting site exists for a considerable time. Butler (1897:1118) says that Bewick Wrens "persistently return to the same nesting place." His evidence is that the same place was occupied for three years in succession. At Mr. Dyer's home the wrens nested each year for over ten years, but it is doubtful if the same pair returned over a period as long as this. In Strawberry Canyon four nesting sites that I found were not used the following year.

On April 6, 1938, I found a pair of wrens in Strawberry Canyon engaged in building. In the morning I saw both birds foraging through the brush and moving slowly down the hillside. The male was uttering *pee* notes and was taking the lead. The female was silent. She picked up a wisp of grass in her bill, whereupon both birds flew down the hill and were silent. I failed to find them for ten minutes and then heard them up the hill. After following them a few minutes more the female disappeared. Two days later, at 6:30 a.m., nest building by this pair was proceeding rapidly. Only one bird, the female, was carrying material. The male perched, preened, and foraged in nearby bushes. The female moved up and down the hillside rapidly, taking almost exactly five minutes per trip for six trips. Her procedure was to fly a short distance from the nest and then hop along the ground searching for material. She picked up wisps of grass, shaking them as she went. After gathering two or three pieces she flew toward the nest (in a hole in the hillside) low down through the brush. This was so thick and her movements so rapid that I could hardly keep her in view. As she passed the male on her way back to the nest she always gave one or two low *sperr* notes. The male sometimes reacted to these by flying toward his mate and following her for a few feet. He always reacted by giving many *pee* notes.

At 7:15 a.m. the next morning the same behavior was observed except that the female now carried soft materials (rabbit fur). I found the nest on this morning and

as I crouched about five feet from its entrance the female returned with fur in her bill. She flew nervously from twig to twig, but was afraid to enter the nest hole with me so close. In a few minutes she and her mate left, the latter having given only a few soft *pee* notes. The female gave no calls at all. This was the last I saw of the building of this nest. The nest was much too far back in the hole in the hillside for me to see how building was done.

On April 7, 1939, I again observed a pair of wrens building. In a period of three hours, from 9:40 a.m. to 12:40 p.m., the female entered the nest five times, twice carrying nesting material. She averaged one minute in the hole per trip. The male in the same period entered the hole thirteen times, carrying nesting material seven times, food for the female (who was not there) twice, and once carrying out a leaf. He remained in the hole from ten to sixty seconds each time, with an average of twenty-two seconds per trip. The nest cavity was about ten feet high in the trunk of a live oak, and the materials being carried in were leaves, twigs, and pieces of ferns. On April 8 at the same nest, from 10:27 to 11:33 a.m., the male was working alone. In this period he entered the hole twenty-one times, carrying nothing four times, and averaging twenty-five seconds in the hole. He still was carrying leaves and twigs. On April 9 both wrens were working and were carrying in some finer materials in addition to coarse ones. They carried out as much material as they took into the nest. I could not tell whether or not they brought out the same material that they took in. This situation may have resulted from a change in the type of materials used in construction. Or, they may have been carrying out some debris in the cavity that had been there previous to their operations. On April 10 the nest was lined with a few coarse fibers. On April 11 there were a few soft feathers in the lining. By April 17 the nest was finished. This nest was constructed in eleven days. Nests which are started earlier in the season may take much longer. One pair which began building in February ceased work during some cold rainy days so that over a month elapsed before their nest was finished.

The behavior of the wrens during nesting is admirably suited for keeping the nest concealed. The thick brush of the habitat, the quietness of the builders and the concealed position of the nest all make the finding of one a feat, and it is for this reason that my observations are based on so few nests. This secretive behavior continues throughout the incubation period, but when young are present, the parents make themselves much more conspicuous.

Burns (1921:91) gives the length of the nesting cycle as 52 to 53 days. This is probably a little short, the variable factors being the time of building the nest and the laying of the eggs. I have seen a nest built in 10 days, and a set of eggs laid in 6 days. Butler (1897:1117) gives the incubation period of nestling life as 14 days. This totals 44 days, but does not include the extra two weeks or so that the parents remain with the young, which would bring it to about 58 days. This figure might be much higher in some instances.

Behavior during the laying period.—On April 9, 1938, I found a female wren (F1) in Strawberry Canyon engaged in lining a nest with fur and feathers. I interrupted this work by being at the nest when she returned with material. For the next three days I failed to find her and heard only the male in the vicinity of the nest giving *pee* notes. I failed to visit the nest for several days, thinking the female had deserted. On April 17, at 8:00 a.m., there were two eggs in the nest. At 6:00 p.m. that evening there were no more and no birds were seen. The next morning at 7:00 a.m. there were three eggs and no birds were found. At 8:00 p.m. on this day I visited the nest and looked in the hole, using a flashlight. One bird was sitting on the eggs. This indicates that some incubating may take place at night before all the eggs are laid. This wren was evidently nervous and fluttered out into the brush. There were still three eggs present.

The next morning (April 19) at 6:00 a.m. the female was on the nest and I heard the male singing nearby. The bird on the nest flew off immediately as I approached, and I found four eggs. The last one, then, was laid before 6:00 a.m. in the morning and the others probably at about the same time, one every day. The next day (April 20) at 8:00 a.m. there were five eggs, and no wrens were found near the nest.

About 9:00 a.m. both wrens came foraging up through the brush about fifty feet below the nest. One bird gave *pee* and the other *sweet* notes. The *pee*-calling bird, evidently the male, fed the other seven times in six minutes, while both birds were in among the smaller branches of a small live oak. The *pee*-calling bird then flew off thirty feet and sang. During feeding the female perched and foraged slowly and kept up a continuous series of hoarse *sweet* notes, which resembled begging notes of some other birds. The male foraged silently within a few feet of his mate and would soon find some small white article of food, which he sometimes shook and pecked several times. Then he would fly and hop with it to the female, who would take it from the tip of his bill with considerable increase in intensity and tempo and a rise in pitch of her *sweet* notes. After feeding several times both birds became silent and wandered off through the brush, the female lagging behind her mate. I observed this same behavior in a pair of wrens in Piedmont at somewhere near the same stage of laying. Another pair of wrens (in Strawberry Canyon), whose nest I had not found, showed similar behavior except that I did not see the feeding act, although I observed the birds for short periods on several days. The female gave the *sweet* notes as she foraged and at times the male flew toward her and may have fed her, but the brush was too thick for this to be seen. On April 19, 1939, I found another laying female. The first egg was laid on April 19. On the 20th the female entered the nest at 5:45 a.m. and the second egg was laid before 6:15 a.m. On the 21st the female entered the nest hole at 5:50 a.m. and the third egg was laid before 6:21 a.m. On the 22nd the female entered at 5:46 a.m. and left before 6:15 a.m., leaving a fourth egg in the nest. On the 23rd the female laid the fifth egg between 5:42 and 6:05 a.m. The last egg was laid the next day. In another nest the female also laid early in the morning, six eggs being laid in seven days. No egg was found the fourth day.

Incubation.—On the morning of April 21, 1939, the set of eggs of the wren F1 was completed. Previous to this, steady incubation had not begun. The morning of the day before, April 20, both birds were observed for one-half hour foraging together. This morning, April 21, a bird flew off the nest as I approached, and I found the eggs warm. The next day, the second after completion of the set, I was at the nest for one-half hour in the afternoon without finding any wrens. On the third day, the 23rd, as I approached the nest in the morning, a wren flew out and disappeared quietly into the brush. A wren was singing fifty feet or so down the hillside, so that the bird on the nest was probably the female. I sat down in plain view about twelve feet from the nest. In a few minutes she returned (another wren still singing below) and flew from twig to twig, foraged, and preened on the opposite side of the nest from me, but was afraid to enter. After fifteen minutes of this, she flew away into the brush again. I went down the hill and hid. Eight minutes later she appeared, gave a *sper* note, perched on a bush seven feet from the nest entrance, and flew into the hole in one flight.

The next morning, the 25th, there were no birds at the nest as I passed by, but the eggs were warm. About noon, April 26, I was hidden at the nest, when the female flew out and down the hill, giving two loud nasal *spa* notes as she went. The male was singing below. Thirteen minutes later a wren, evidently the male, appeared at the nest with food in his bill. He did not enter the nest in a single flight but made several stops, finally hopping into the hole. The female, of course, was not on the nest. The male

came out of the hole in a few seconds, still carrying the food. He flew to a nearby bush and gave several light *ku-wee* calls, the only of this kind I had ever heard from him. He then left and about five minutes later the female returned, gave two sharp *spa* notes, pecked a few insects off a twig, and flew directly into the nest hole, where she remained. I heard the other bird singing from down the hill. The nest had been uncovered for twenty-four minutes. I left and returned an hour later. Again I saw the female leave the nest for a period of about twenty minutes.

The next morning at 6:50 a.m., when I arrived at the nest, the female was in it, and the male was singing from down the hill. In fifteen minutes he appeared with food in his bill, flew to the nest hole, hopped in, came out in a few seconds without the food, and departed down the hill giving a few *pee* notes as he went. Ten minutes later the female flew directly out of the nest hole and down the hill. Seven minutes later she appeared and flew directly into the hole. I heard the male singing from down the hill.

These actions seem to warrant the conclusion that the female does all the incubation, at least in the early stages. She leaves the nest for short periods to forage and to be fed by the male. The male may also feed her at the nest. Unfortunately, my observations have always been interrupted at this point in the season. I have no data on the remainder of the period of incubation.

SUMMARY

The habitats of several subspecies of the Bewick Wren (*Thryomanes bewickii*) in the western United States are described. Animal and plant associates differ greatly throughout the range of the species. The wrens most commonly occur in thick, mixed brush associations. They depend upon the plants of their habitat for invertebrate food, shelter, singing perches and, to a large extent, nesting sites.

The relations of Bewick Wrens to other vertebrate animals of their habitat are mostly neutral. They probably are preyed upon to a slight extent by bird-hawks and owls. Where the wrens nest about buildings in suburban areas, they sometimes have conflicts over nesting sites with House Wrens, titmice, and other small birds. Under these circumstances the Bewick Wrens usually retreat.

Some individuals have been found roosting in cavities. Bathing in both dust and water occurs.

Foraging takes place on the ground and on the limbs and foliage of bushes and trees. In foraging, the birds use their bill for picking insects off leaves and branches, for flicking over leaves on the ground and, less commonly, for digging insects from cracks in bark. They do not scratch for food. They forage rapidly, and this activity takes up the larger part of their time. The method of foraging varies in accordance with the size and distribution of the plants in their habitat. In early spring the male of a mated pair forages high up in brush and trees, and his mate forages low down in brush and weeds.

Only the males sing. Males, at least of the race *spilurus*, do not sing throughout the year; they cease for a month or two in late autumn. Most of the singing occurs in early spring before nesting. A large number of songs were recorded in syllable form, and the composition of the songs was analyzed. The separate notes vary greatly in pitch, quality and length. A trill usually is present in the song. Each song may have from two to seven distinct parts, and may last from one to three seconds. The songs of the wrens in Arizona, Texas, and northeastern Mexico differ noticeably from those of wrens along the coast of California. The songs of *spilurus* and *marinensis* are considerably more complex and varied than those of *cremophilus*, *cryptus*, *percnus* and *murinus*. At one place a small local variation was noticed in the songs of *percnus*. Songs are given from

one to eighteen per minute; the wrens sing from perches or when foraging. Singing appears to help in maintaining territories.

Both male and female wrens have a variety of call notes; most of these are different in the two sexes. The male has mildly harsh notes that probably are used for making his whereabouts known to his mate and to rival males. He has several kinds of harsh notes that are used in territorial encounters. One special kind of note develops in the spring and is heard in this season only. The female gives few notes; such as they are, these seem to enable the male to keep near her. She has a special note that she gives to call the male for copulation. Also, "begging" notes seem to stimulate the male to feed her.

Bewick Wrens are found throughout the year either singly or in pairs. Most commonly the males appear on territories in the early spring and are mated shortly afterward. Males of *T. b. spilurus* show territorial reactions toward other males at any time of the year, although much more frequently in the spring. Females show no such reactions toward males, at least, and probably have no part in the defense of territory. Males and mated pairs have territories in the spring and may possibly have them in the winter. The territories of several wrens were mapped; they proved to be about fifty yards wide by one hundred yards long.

The territorial conflicts of *spilurus* occur frequently along boundary lines, and consist of vocal battles. The wrens rely upon harsh vocal notes and singing for the defense of their territories. Certain features of the vegetation and topography of the habitat are correlated with the boundaries of territories.

Bewick Wrens' nests are placed in secluded cavities in or near the ground. Each nest has a well defined cup of soft materials and usually has a base of small twigs. Most nests are open above; rarely they are arched over the top.

The male may develop slight nest-building instincts before he is mated, but in most instances nests are not built until the female is present. Both mates may build the nest, although the male works sporadically, and the female often builds alone. Usually only one nest is built, although some authors state that several are sometimes begun.

The nesting season in *spilurus* may begin in late February and may extend to the middle of June. The total nesting cycle is about 58 days in length. The nest may be built in 10 days and the eggs may be laid in 6 days. The periods of incubation and nestling life are about 14 days each. The parents probably care for the young for about two weeks after the latter leave the nest.

Three females were observed to lay their eggs early in the morning; each female laid at about the same time each day. Two sets of eggs usually are laid, with from three to eight eggs per set; six is the most common number. Only the early stages of incubation were observed; the female carried on this activity. At this time the female leaves the nest for a few minutes at a time to forage, and in addition is fed by the male.

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A RED FIGWORT AS THE IDEAL NEARCTIC BIRD-FLOWER

By A. L. PICKENS

With this article appears the third installment of the Condor list of ornithophilous flowers which was begun in 1931 as a result of suggestions by Dr. Otto Porsch and Dr. Joseph Grinnell. The figworts, or Scrophulariaceae, continue to lead all plant families, and red, all colors among bird-visited native or introduced flowers found in the Nearctic region. White has passed all colors except red, which latter is present in some 30 per cent of the recorded plant species.

But not every test shows red ahead. A single Ruby-throated Hummingbird busy with a large *Abelia* clump conspicuously neglected some scraggly red salvia-like plants and a violet *Achimenes* growing near by. But the latter's S-like tube and key-hole-like opening may discourage long-billed probers. Six uniform-sized sugar-watered artificial flowers gave the following results with Ruby-throats:

	Red	Orange	Yellow	Green	Blue	Violet
Short drinks	17	15	3	4	10	29
Long drinks	5	2	....	....	....	7
Dancing drinks	7	4	....	....	2	17
Examinations	27	14	7	12	12	12
Long examinations	1	....	....	....	....	....
Dancing examinations	2	....	....	2	....	2

By "dancing" is meant the exhilarative buzzing up and down above the flower, with time out at the end of each descent either for a drink or for scrutiny of the flower. Obviously summation of the varied elements of the foregoing table is difficult, but whichever way the different kinds of "visits" are evaluated, violet appears to lead.

Smaller containers, extra tones, and closer grouping in a second experiment gave fewer of those actions difficult to evaluate. The results were:

Visits	Maroon	Red	Pink	Orange	Yellow	Green	Blue	Violet	White
	29	37	37	32.	34	36	36	46	37

Violet again! Each time, however, red seemed to have the best drawing and holding power. In the first experiment, one bird stretched out on a large leaf before the red flower, like a basking squirrel on a limb, and drank and drank, until only a stop-watch or graduated containers could have given a proper answer. In the second experiment, the red, now smaller, was drained at the first visit and so was "handicapped." How I have felt the need of that sea-fed drinking horn with which the Jotunnheim giants deceived the boastful Thor, proud of the load he could carry! Also, violet buddleia had long fed birds in the yard where number 2 was conducted and may well have influenced choice. One hummingbird, lantana-trained perhaps to look on red as the color of a dying flower, rose from its lantana clump to examine a red artificial flower but was never seen to drink.

But sophistication at times bends back upon ignorance. In an Atlanta park, birds in a mimosa grove, exposed to neighboring sign-tubes and gadgets, gave passing examination only to the red and orange sugar-flowers and drank from none. The Cardinal may be brought to a window by its own reflection. A pet duckling with a fear of red and a love of human company was so observant that it could be pacified when left alone by a pair of shoes over the tops of which trouser legs had been dropped in a natural manner from a lawn seat above. When older it would enter the house and bully a pair of child's red bedroom slippers, shoving them all about the floor.

Although statistical information is still meager, at present, non-trochilid flower-

visiting birds appear to favor orange, then yellow including greenish-yellow, with white, red, and violet following in order. The popularity of orange *Grevillea* and century plant affects this finding. Dr. Loye Miller sends in some additional names for this non-trochilid flower-visiting group, bringing the number to twenty, as follows:

White-winged Dove
Flicker
California Woodpecker
Steller Jay
Chestnut-backed Chickadee
Arizona Verdin
Bush-tit
Mockingbird
Golden-crowned Kinglet
Cedar Waxwing

Phainopepla
Blue-winged Warbler
Yellow Warbler
Audubon Warbler
Arizona Hooded Oriole
Scott Oriole
Western Tanager
Black-headed Grosbeak
Common House Finch
Pine Siskin

These are chiefly western records, nectar-drinking possibly originally arising from the desert-induced thirst, rather than a quest for insects. But, here in Paducah, Kentucky, Cedar Waxwings have been seen at *Crataegus*, and Kate M. Roads of Ohio found Golden-crowned Kinglets visiting the red salvia.

Observers should carefully distinguish between regular visits of old birds and the tests made by young or inexperienced birds. Visits to tulips and poppies are suspect. Always examine nectarless, and also non-showy flowers for possible aphid infection. Rich blue *Salvia patens*, a Mexican bird-flower, is surprisingly neglected by Anna Hummingbirds at times when planted in California. A Ruby-throated Hummingbird has been seen to examine crane-fly orchids meticulously without attempting to secure food. A favorite flower in one garden may be neglected in another because of neighbors with richer nectaries. The third list of bird-flowers follows (for the two previous lists see Condor, 33, 1931:23-28; and 38, 1936:150-154):

- Polygonaceae. Lady's finger. *Persicaria orientalis*. Rose.
Caryophyllaceae. Garden pink. *Dianthus plumarius* (?). Pink and red.
Ranunculaceae. Giant clematis. *Clematis viticella*. Violet and white.
Nymphaeaceae. Water-lily. *Castalia odorata*. White.
Calycanthaceae. Sweet-shrub. *Calycanthus floridus*. Maroon.
Saxifragaceae. Common alum-root. *Heuchera americana*. Red and maroon.
Mock orange. *Philadelphus grandiflorus*. White.
Deutzia. *Deutzia purpurescens*. White.
Rosaceae. Cherokee rose. *Rosa laevigata*. White.
Hawthorn. *Crataegus crus-galli*. White. (Western species in 1931 list.)
Fabaceae. Rose locust. *Robinia hispida*. Rose.
Red-bud. *Cercis canadensis*. Pink. ("Texas red-bud" in 1931 list.)
Euphorbiaceae. Snow-on-the-mountain. *Euphorbia marginata*. White.
Malvaceae. Swamp mallow. *Hibiscus lasiocarpus*. White or pink, with crimson.
Tamaricaceae. Tamarisk. *Tamarix junipera*, etc. Pink.
Cactaceae. Flat-stem cactus. *Epiphyllum Ackermanni*. Red.
Begoniaceae. Tuberous-rooted begonia. *Begonia* sp. Red.
Lythraceae. Cigar-plant. *Cuphea ignea*. Red.
Ericaceae. Sourwood. *Oxydendrum arboreum*. White.
Primulaceae. Shooting star. *Dodecatheon Meadia*. White; rose.
Oleaceae. Golden bell. *Forsythia viridissima* (?). Yellow.
Night jasmine. *Jasminum* sp. White.
Convolvulaceae. Moon-flower. *Calonyction aculeatum*. White.
Wild potato. *Ipomoea pandurata*. White and pink.
Polemoniaceae. Wild phlox. *Phlox* sp. Blue; pink.
Solanaceae. Nightingale trumpet; Angel trumpet. *Datura suaveolens*. White.
Tobacco. *Nicotiana tabacum*. Pinkish.



- Boraginaceae. Blue bell. *Mertensia virginica*. Blue and pink.
 Viper's bugloss. *Echium vulgare*. Blue and pink.
 Verbenaceae. Blue vervain. *Verbena hastata*. Blue.
 Glory bower. *Clerodendron bungei*. Violet red.
 Lamiaceae. Physostegia. *Dracocephalum virginianum* (?). Red; violet.
 Salizaria. *Salizaria mexicana*. Violet.
 Scrophulariaceae. Great mullein. *Verbascum thapsus*. Yellow.
 Pentstemon. *Pentstemon baccharifolius*. Red.
 Pentstemon. *Pentstemon eatoni*. Red (?).
 Heal-all. *Scrophularia marilandica*. Maroon.
 Morocco toadflax. *Linaria maroccana*. White and rose.
 Valerianaceae. Corn salad. *Valerianella eriocarpus*. Bluish, or rose.
 Carduaceae. Silver-leaf sunflower. *Helianthus argophyllus*. Yellow.
 Knapweed. *Centaurea macrocephala*. Yellow.
 Sweet sultan. *Centaurea moschata*. Lilac.
 Alismaceae. Arrowleaf. *Sagittaria* sp. White.
 Commelinaceae. Zigzag spiderwort. *Tradescantia pilosa*. Violet blue.
 Liliaceae. Regal lily. *Lilium regale*. White and pink.
 Amaryllidaceae. Tuberose. *Polianthes tuberosa*. White.
 Orchidaceae. Purple fringed orchid. *Habenaria psychodes*. Magenta.

In assembling this list Mrs. Jack Hagar of Texas, Kate M. Roads of Ohio, Aretas A. Saunders of Connecticut, and Robert S. Woods of California continued to give the same valuable aid which it is hoped is by now habitual. Letters from G. R. Johnstone, H. B. Lovell, Donald Culross Peattie and notes from E. W. Gudger and W. L. McAtee yielded a number of other names of bird-flowers. Dalton Bagwell, L. V. Bean, Betty J. Ellis, Louise and Sue Gentry, Wilimina Gramse, Anna J. McKinney, David S. Marx, Doris and Juanita Miller, Lee Molloy, Loree Stone, and Margaret Yarbrow have each aided with the list. William Beebe, H. Hapeman, J. M. Linsdale, C. V. Morton, and F. W. Pennell have assisted with their answers to inquiries on related subjects. Thanks are due to each for his kindness.

Once more the question is asked: Is thistle sage bird-visited? Are the other western flowers mentioned with it in 1936 visited? Does the strange cheesy odor of the century plant indicate that bats come to it by night as well as birds by day? Thus closes the third semi-decadal list, leaving the bird-flowers chiefly among the figworts and largely in the red.

NOTE.—Bent (U. S. Nat. Mus. Bull. 176, 1940) gives some additional flowers visited by hummingbirds. These were noted too late for inclusion above; they bring to more than four hundred the number of species on the three lists.

Rosaceae. Thimbleberry. *Rubus occidentalis*. White.

Plum. *Prunus domestica*? White.

Fabaceae. Ironwood. *Oleaya tesota*. Lavender.

Solanaceae. Lycium. *Lycium andersoni*. White; lavender.

Lamiaceae. Hyptis. *Hyptis emoryi*. Violet.

Scrophulariaceae. Monkey-flower. *Mimulus implexus*. Yellow.

Lousewort. *Pedicularis semibarbata*. Yellow.

Asclepiadaceae. Desert Milkweed. *Asclepias subulata*. Pale yellow.

Caprifoliaceae. Mountain Honeysuckle. *Lonicera dioica*. Purplish or yellowish.

Paducah Junior College, Paducah, Kentucky, November 29, 1940.

WINTER BEHAVIOR OF RAVENS AT TOMALES BAY, CALIFORNIA

By JOHN E. CUSHING, JR.

The Raven (*Corvus corax*) is a common bird along the coast of Marin County, California, particularly in the vicinity of Point Reyes and Tomales Point. Here during the breeding season it is to be found nesting either on the ocean cliffs or in small trees, as in the brushy ravines along Drake's Estero. At this season ravens usually occur in pairs, creating the impression of a solitary and individualistic way of life.

For several years the author had noticed a regular flight of ravens in the fall and winter in the vicinity of Tomales Bay. This was particularly marked on Tomales Point where every evening ravens could be seen and heard calling as they flew northward to cross the bay in the vicinity of Hamlet. In the morning ravens would pass southward along the point. Such a habit suggested obviously enough that the birds were roosting gregariously somewhere to the north and east of the bay.

On August 4, 1937, an attempt was made to verify this supposition by driving along the line of evening flight where it left Hamlet. At 3:30 p.m. ravens were heard calling near Hamlet, but could not be seen because of heavy fog. At 3:45 five were flushed from the highway near the town of Tomales (see fig. 28). These flew off to the south, soon to be lost in the fog. At 5:30 several were seen flying northeast under the fog three miles south of Valley Ford, Sonoma County. Shortly after this, at 5:45, one hundred birds were seen in a field on the Alfonso Ranch one mile east of Valley Ford. The birds were in two bunches when first seen; they were lying down or walking and doing little else. Other ravens joined these groups, arriving from the southwest, uttering single notes and flying under the fog about seventy-five feet above the ground. By 5:50 the number of ravens had increased to 160 and no more birds were seen coming in. Then, at 5:55, twenty-four more arrived, flying leisurely and giving the same single notes mentioned above.

The birds now began a gradual drift toward the northwest end of the field where a flock of fifty birds was finally assembled by 6:05. At 6:10 a total of two hundred birds was counted. A few crows could be heard calling, but the ravens were quiet. At 6:22 p.m. birds began to leave the field and fly off toward the southeast, disappearing into the fog. As it was becoming too dark to see very well, I flushed the main flock and they too vanished to the southeast. A few crows were mixed with them.

Opportunity for further investigation did not present itself until September 4, 1940, when the drive from Hamlet was retraced. At 3:10 p.m. two ravens were seen flying about near Hamlet and giving single call notes as had the other birds three years before. When I arrived at the field on the Alfonso Ranch at 3:30 p.m., no ravens were to be seen. At 4:45 two were observed flying south along the crest of a bare hill. No more were seen, and the situation was discouraging until at 5:49 twenty-five to thirty birds were discovered on the bare hill just mentioned. They were in sight of the Alfonso field, but about three-fourths of a mile to the southeast of it (the direction taken by the flock three years ago). As I watched, one bird joined this group. Ten minutes later another flock of about seventy birds was discovered a hundred yards or so to the south of the first on the same hill, in a plowed field. A count of the other group showed them to be now about fifty strong.

At this time I drove down to the Lepori Ranch, at which place the birds were situated, and walked over the hill, attempting to come upon the first flock from the east. At 6:00 p.m., while climbing the hill, nine birds flew over in a group from the east toward the big flocks, uttering the single caw and in addition gurgling. At 6:12 a single

bird came in from the east, followed by two more. Three minutes later I flushed the first flock, counting fifty birds. These flew off to the larger bunch, still out of sight over the hill.

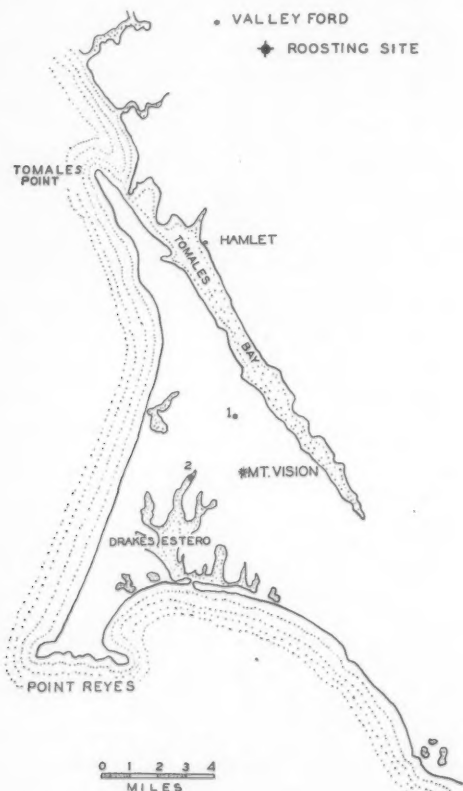


Fig. 28. Map of Tomales Point and vicinity, Marin County, California, showing location of Raven roost.

The birds had been standing in an old hay field. Along the fence forming its southern boundary were quantities of raven feathers. At 6:20 the other flock, now about two hundred, flew over me although I had not startled it. As usual, the birds were uttering the characteristic single note. They were relatively tame, passing several times within easy shot-gun range. By 6:35 they had again settled down, this time out of sight on the northern slopes of the hill, and they were making little noise.

The hill mentioned several times above is a "bald" elevation, about five hundred feet high, situated two and one-half miles east and a little south of Valley Ford. The country about the hill forms a rough basin, and the hill is the highest ground within two or three miles in any direction. The nearest forested country is about four miles to the north. The hill itself is steepest on the east and north face, with a small brush-covered canyon on the north in which the ravens roost. At the head of this canyon are

two or three eucalyptus trees, the only trees of any size on the hill. Two hay fields have been made on the hilltop, which is a little less than one-half mile at its greatest diameter. In general, there seems to be nothing outstanding about the location of the roosting grounds.

Returning to the story of the ravens of September 4, 1940, at 6:50 about sixty birds had returned to the hay field, almost all of them facing west and making no noise. Birds also appeared flying low over the brushy canyon, apparently settling there to roost as at this time it was almost dark. Some birds flew into the trees at the head of the canyon and, after much restless moving about accompanied by low, strange noises, started to settle down. The birds from the hay field began to fly over and drop from sight into the canyon and their numbers dwindled from sixty to twenty-five and finally to ten. During this interval, many faint caws could be heard coming from the trees. The ten birds finally left the field at 7:05 and vanished into the canyon when it was so dark they could hardly be seen. At this time I left, although noises were still audible from the heavy brush as I passed along the canyon.

From the above observations, it seems probable that the ravens in the vicinity of Tomales Bay do roost together during the winter and that this roosting place is of a permanent nature and has been used for a long time. A similar habit is recorded for the Raven (*C. c. corax*) of England by Witherby, Jourdain, Ticehurst, and Tucker (Handbook of British Birds, 1, 1938:8): "Pairs associate throughout the year, but reputation for solitary habits largely due to comparative scarcity in many districts. Where sufficiently numerous may congregate in flocks for foraging purposes and roost gregariously on suitable rock ledges, etc., sometimes in large numbers (over 100 apparently normal in O. Hebrides); also in tall trees. Parents roost away from nest soon after young hatched. . . . Social gatherings like those of other *Corvidae* occur where birds are common enough, chiefly in autumn and winter. . . ."

The following notes indicate something of the daytime dispersal from the roosting site. On February 21, 1937, these observations were made on Tomales Point opposite Hamlet: At 7:15 a.m. eight ravens passed along the point, flying south, to be followed by two birds three minutes later. At this time the first rays of sunlight were visible on the higher hills of the point. At 7:23 a single bird appeared, and by 7:44 twelve more birds in threes, twos and as singles had moved southward, flying in a straight course. At 7:50 birds were heard calling over the bay and again at 8:06 ravens called high in the air. At 8:17 three flew by me, low and near the bay, this time moving north. Another single bird went southward, and the last ravens were seen at 10:20 when two flew south quite high, moving very fast and croaking repeatedly.

That same evening a small return flight occurred at the same place, three birds crossing the bay two miles below Hamlet at 5:22 and three flying north over the bay at 5:40. A morning flight was observed next day, similar to the one just discussed.

Further observations were made from Inverness Ridge on September 6, 1940. Here a stand was taken on a broad shallow saddle about two miles wide, that seemed to offer a natural crossing for ravens coming from Point Reyes (see 1 on map, fig. 28). From this saddle the land flattens out to the west and south in the vicinity of Drake's Estero and the point. From here, on a clear day, one can easily see the Farallones and Mount St. Helena.

At 4:00 p.m. three birds came flying steadily toward the saddle from along the western side of Mt. Vision, to cross near me and pass northward up Tomales Bay. Two of these birds often dove at each other as if in play, although they continued their course. At this time four birds were seen on the ground not far from my stand. Two of these soon moved to a field about a mile to the west, a third disappeared, and one remained.

Within five minutes of the time that the three flying birds had been first sighted, a flock of twenty-three birds was located (at point 2 on the map) as it came up the eastern arm of the estero high in the air and moving forward in a progressive circle. At 4:10 the first calls from this flock could be heard above the wind and at this same time the two ravens in the field flew away. As the flock rapidly passed over me and out above the bay, the single raven on the ground was still feeding. At that time I lost sight of the flock and turned to look at the single bird, only to find that it had left. At 4:15 in a line with the eastern arm of the estero and the saddle, a large group of birds was seen just as it dropped from sight behind the eastern hills of Tomales Bay. Probably this was the same flock of ravens, for the line of flight was roughly toward the roosting place.

At 4:40 p.m. birds were heard, but not seen. Shortly afterwards I left the ridge. At 5:25 on the highway at a point one mile east of where it touches the estuary, two ravens flew up the canyon toward the east, flying low and calling repeatedly.

These observations show that some of the birds in the winter assemblage make a daily round trip of over forty miles (for example, those observed coming up Drake's Estero). It is almost certain, considering the homogeneity of the country southwest of Mt. Vision, that some birds make a daily trip to Point Reyes, some twenty-three miles in a straight line from the rookery. In view of the fact that ravens have nested on the Farallones and that these islands are easily seen from Point Reyes on a clear day, being only twenty miles south of it, it is possible that a few birds may cross over to them and return in the course of a day. Another possible area of daily foraging is down the coast of Drake's Bay toward the Golden Gate. How far the Tomales birds may go in this direction is still unknown, although I have at various times seen ravens in small numbers along this entire coast-line.

A scattering of observations are to be found in my notes, confirming the above data upon the manner and extent of the colony's daily dispersal. There is no need, however, to publish these in detail.

In regard to the length of time the Valley Ford site has been in use, my earliest note was made on February 18, 1933, at Tomales Point when three ravens were seen at evening flying north. Accompanying this record is the statement that ravens have been seen to do this before, suggesting the possibility of a winter roosting site. Further notes taken that same spring show a definite flight similar to that described for 1937. Therefore, the ravens have probably been using the Valley Ford roosting grounds for at least nine years.

The two counts that have been made at the roost show that the number of ravens was about two hundred in 1937 and in 1940.

Although several extensive stands of eucalyptus occur close to the roosting grounds, one even at the eastern base of the hill, the majority of the ravens, as far as was determined, appear to prefer to roost in the brushy canyon on the hill. As eucalyptus is not a native tree in California, it is possible that the birds are adhering to a custom originating at a time before the groves were in existence. That this custom may become changed, in a manner paralleling that of the crows of New York (Emlen, Ecology, 19, 1938:274), is suggested by the fact that some of the birds are using the few eucalyptus growing at the canyon head.

In connection with these observations on ravens, we may consider some of the evolutionary aspects of colonial behavior such as they display. Emlen (Condor, 42, 1940: 287-294) has shown that the Western Crow (*Corvus brachyrhynchos hesperis*) has not extended its winter range in California in the past fifty years. This is true in spite of the facts that crows have increased in some areas and that much territory that appar-

ently is suitable ecologically is and has been available for such an extension. Emlen presents evidence (p. 294) "for the existence of an innate affinity or homing reaction to established territory which, independent of environmental factors, acts in delimiting the winter distribution of the crow in California." This explanation would seem to apply also to Bryan's statement (Natural History of Hawaii, 1915:335) that the Hawaiian Crow (*Corvus hawaiiensis*) "having originally gained a foothold in the Kona and Kau districts of Hawaii, . . . seems . . . unwilling to extend its range to the windward forests that adjoin i[t]s habitat, even though they are known to abound in suitable food." Likewise this homing reaction may conceivably be the causal mechanism that brings the Tomales Bay ravens to the same roost from winter to winter.

If we accept such a homing reaction as the force that maintains the individuality of crow and raven roosts year after year, we can see in it a potential isolating mechanism that will be effective in just the proportion to which it tends to prevent the exchange of genes between populations. This effectiveness will, of course, have to be determined for each population involved, but at least the possibility that such a mechanism is at work must be considered.

An analysis of the homing reaction into its hereditary and non-hereditary aspects may show that the latter aspects are the significant ones wherever any isolation is taking place. That is, it is probable that an individual acquires rather than inherits its special attachment for a particular roosting site, even though it probably inherits the ability to form this attachment. With this the case, if we are to consider the homing reaction as a potential isolating mechanism, it may be classifiable as on a par with geographic isolation (see Dobzhansky, Genetics and the Origin of Species, 1937:230), although itself physiological in nature. Such non-genetic mechanisms, while presumably of relatively temporary nature, theoretically precede the rise of genetic isolation within populations (*op. cit.*:256).

Whereas the foregoing discussion has been focused on the homing reactions of certain corvids in winter, the widespread occurrence of homing phenomena suggests that similar isolating mechanisms may occur in other species.

SUMMARY

The ravens in the vicinity of Tomales Bay, Marin County, California, roost together in a brushy canyon on a small hill near Valley Ford, Sonoma County, during the fall and winter months. During the day the birds disperse over the surrounding country, some of them apparently travelling at least forty miles in a day. The colony numbered about 200 birds on the two times that counts were made. It has probably been in existence for at least nine years, quite possibly much longer.

The maintenance of the colony as a unit is attributed to a homing reaction similar to that postulated by Emlen as limiting the mid-winter distribution of crows.

The possibility that such a reaction may act in some cases as a non-genetic isolating mechanism was raised and briefly discussed.

California Institute of Technology, Pasadena, October 9, 1940.

BIRD RECORDS FROM SOUTHERN AND WESTERN ARIZONA

By GALE MONSON and ALLAN R. PHILLIPS

In the period from June 15, 1939, to July 5, 1940, the authors made nine brief trips from Tucson to various points in southern and western Arizona. A number of records of birds made in the course of these trips are presented below. At least two birds, the Yellow-bellied Sapsucker and the White-throated Sparrow, are here recorded for the first time from Arizona. All specimens mentioned below are in our own collections, or, in a few cases, in the collection of Lyndon L. Hargrave. Certain additional records of one or the other author are included where necessary to demonstrate more clearly the probable status of a species.

Mergus merganser. American Merganser. Two females were seen on February 18 on the Colorado River west of Yuma. No other records are known to us from the lower Colorado River.

Buteo swainsoni. Swainson Hawk. One was seen at Santan, just northwest of Sacaton, Pinal County, and one 15 miles east of Salome, Yuma County, on June 17, 1939. On our return, June 26, one was seen a few miles northeast of Kingman, one in the same valley but a little farther northeast, and one eight miles west of Peach Springs station, Mohave County. On May 30, one was seen at Feldman and one several miles west of Oracle, Pinal County. These records indicate an extensive breeding range in Arizona. All birds seen were in "normal" plumage, as far as could be determined.

Buteo regalis. Ferruginous Rough-leg. One was flushed by Phillips from the prairie eight miles west of Peach Springs station on June 26, 1939. This is decidedly west of points of previous summer records for Arizona. A melanistic adult was seen soaring two and one-half miles west of the Gila Mountains, between Yuma and Wellton, and another in "normal" plumage 12½ miles west of Gila Bend on February 18. Monson also saw one eight miles west of Gila Bend on December 24, 1939. Lack of authentic records in earlier literature would indicate this hawk to be rare in southwestern Arizona.

Falco peregrinus. Duck Hawk. An adult was seen chasing Mourning Doves at Patagonia, Santa Cruz County, on March 10. Monson saw an adult catch a female teal near the same locality on March 19, 1940. The Duck Hawk, judging by literature and our own observations, is uncommon in southern Arizona.

Gallinula chloropus. Florida Gallinule. Two adults were seen at Topock on the Colorado River on June 26, 1939. This is distinctly a local bird in Arizona.

Fulica americana. American Coot. Eighty or more adults and three juveniles were seen at Topock on June 26, 1939. Lower Sonoran breeding records in Arizona are few.

Actitis macularia. Spotted Sandpiper. One was seen by Robert A. Flock at Menagers Dam in the extreme southwest corner of the Papago Indian Reservation, Pima County, on January 6, and four by us on January 7. There are few previous winter records for Arizona, and these refer chiefly to single birds.

Totanus melanoleucus. Greater Yellow-legs. One was seen at Menagers Dam on January 7.

Pisobia minutilla. Least Sandpiper. A flock of 14, and 30 others, were seen at Menagers Dam on January 7. Three were collected by Hargrave from a flock of eight, 12½ miles west of Gila Bend, on February 17; a flock of six was seen at the same place on the following day. A flock of five was seen in farmlands west of Yuma on February 18. We did not see Western Sandpipers (*Ereunetes mauri*) anywhere in southwestern Arizona in the winter, and therefore cannot but wonder if Price (Bull. Cooper Orn. Club. 1, 1899:91) was mistaken in identifying the small sandpipers he saw below Yuma as Western.

Himantopus mexicanus. Black-necked Stilt. A male was collected by Phillips on February 17 at a small pond 12½ miles west of Gila Bend. This is the first winter record of the species in Arizona.

Chlidonias nigra. Black Tern. An adult was seen at Topock on June 26, 1939. There are no other published summer records for western Arizona.

Zenaidura macroura. Mourning Dove. A set of two eggs, nearly ready to hatch, was taken on February 18 in the willow-arrowweed association along the Colorado River west of Yuma. The nest was two and one-half feet from the ground in a fallen dead arrowweed. This is an early nesting date.

Scardafella inca. Inca Dove. Four were seen near Patagonia on December 3. Three were seen, and a male collected by Phillips (preserved as a skeleton), at the same place on March 9. Inca Doves in Arizona usually occur in cities and villages; the finding of this bird in a brushy river valley away

from habitations is thus unusual and suggestive of its original haunts. Three individuals were also seen on February 17 and 18 at Gila Bend, which is doubtless near the western limit of the bird's range.

Chordeiles acutipennis. Texas Nighthawk. At dusk on January 6, Phillips saw a nighthawk at close range at Menagers Dam; an attempt was made to collect it. Since the known winter range of *C. acutipennis* extends far north of that of *C. minor*, it is presumed that this bird was *C. acutipennis*.

Calypte anna. Anna Hummingbird. A female was collected by Phillips at Patagonia on December 3 near some tree tobacco, which was still in bloom. There are no published winter records from southern Arizona. That this individual would have remained through the winter is, in our opinion, doubtful. We consider it a late fall transient.

Selasphorus rufus. Rufous Hummingbird. Two males and three females were collected at the west base of the Baboquivari Mountains on March 24 and one other was noted. In Phillips' collection there is also a specimen (female by plumage) found freshly dead by a student on April 22, 1939, near the same place. This would indicate that the species is a regular spring transient at least locally in southwestern Arizona. Previous spring records for Arizona are few, and are mostly for dates much later in the spring.

Sphyrapicus varius varius. Yellow-bellied Sapsucker. An adult female was discovered at Gila Bend on February 17 and was taken by the authors on February 18. Aside from a rather long tail measurement, the specimen is typical *S. v. varius*. It provides the first record of this sapsucker from Arizona.

Tyrannus vociferans. Cassin Kingbird. An adult male was taken by Phillips at Patagonia on December 2. It provides the first winter record of the species for Arizona. The specimen has an unusual orange suffusion on the yellow of the belly. Although there is a previous "Jan." record from Nogales (Baird, Pacific Railroad Reports, 9, 1858:175), examination by Phillips shows this to be a misprint for "Jun." One pair, and possibly another bird, were seen on May 30 at Feldman, Pinal County. As far as we know, this is as far down the Gila River system as the species breeds.

Myiarchus cinerascens. Ash-throated Flycatcher. This bird was fairly common at Menagers Dam on January 7, about six being seen on a walk around the lake. On the basis of the literature, we believe it to be absent or rare during the winter elsewhere in Arizona.

Empidonax hammondi. Hammond Flycatcher. A male taken by Monson at Patagonia on February 21, 1940, and another by Phillips on March 10, indicate that the species winters there. Six were seen, five of which were taken, at the west base of the Baboquivari Mountains on March 24. No other *Empidonax* was seen on this date, aside from a male Western Flycatcher (*Empidonax difficilis*) collected by Monson. This seems very early for such a heavy migration, and the locality is not one where *hammondi* would be expected to winter in any numbers, if at all. The species has not previously been reported from the Baboquivaris, but Phillips took a specimen at the same place on April 22, 1939, and it is doubtless a common transient.

Empidonax oberholseri. "Wright" Flycatcher. Monson took a male at Patagonia on December 3. A male was taken by our party, and another heard, at the same locality on March 9; two were noted on March 10. There are no previous winter reports from southern Arizona, but Phillips took a female near Tucson on February 29, 1940.

Empidonax wrighti. Gray Flycatcher. Six were seen on January 7 at Menagers Dam, where it is undoubtedly a wintering species. One was collected at Patagonia on March 10, which date perhaps marks the beginning of the spring migration. In the nomenclature of this and the preceding species we follow Phillips' revision (Auk, 56, 1939:311-312).

Myiochanes pertinax pallidiventris. Coues Flycatcher. One was collected by Phillips on December 3 at Patagonia. There are no previous winter records for Arizona.

Camptostoma imberbe. Beardless Flycatcher. A male was taken by Phillips at the west base of the Baboquivari Mountains on March 24. A female of a pair was taken by Monson and another bird was noted singing at Feldman on May 30. This female has a peculiar admixture of pale yellow feathers in its dusky crest, which is decidedly elongate.

Otocoris alpestris. Horned Lark. The following records help clarify the breeding ranges of the Horned Larks in Arizona. Two adult males, an adult female, and a young female, taken by Phillips from a flock of about 20 seen at Aguila, Maricopa County, on June 17, 1939, and two adult females taken by him 12 miles east of Aguila on July 24, 1939, are *O. a. occidentalis* (approaching *adusta*, or at least nearer *adusta* than specimens from the San Francisco Mountain and Prescott regions). A juvenile female taken by Phillips 22 miles east of Quartzsite, Yuma County, on June 17, 1939, is presumably *leucansiptila*. Although we have no other juveniles of this race, the specimen is much paler than juveniles of *occidentalis* or *adusta*.

On June 26, 1939, two Horned Larks were seen in the valley northeast of Kingman and one a few miles northeast of Valentine; three males and four females, all adults, were taken by Phillips

eight to nine miles west of Peach Springs station, where the birds were common; and others were seen thence as far as Peebles Valley, southwest of Prescott, wherever there was open grassland. The Peach Springs birds are apparently *occidentalis*. Their plumage is so worn, however, that any identification must needs be tentative.

On February 18 about 25 Horned Larks were seen, and two males and one female taken by Phillips and Hargrave, 12½ miles west of Gila Bend; these are *leucansiptila*. The testes of the males were already enlarged.

Two Horned Larks were seen six miles west of Oracle, Pinal County, on May 30. In the same vicinity, Phillips saw a pair and took the male (testes greatly enlarged) on April 14, 1940, and Monson took three adult males, one adult female, and one juvenile female on May 10, 1940. These are *adusta*, although some of them are not typical. Anders H. Anderson of Tucson and Phillips frequently passed through this territory in the 1930's without ever seeing Horned Larks, and this species is not mentioned as breeding in Scott's list of birds from near Oracle in the 1880's (Auk, 4, 1887:20). It was, however, reported from Oracle a few years later (Oberholser, Proc. U. S. Nat. Mus. 24, 1902:858). Possibly the bird has only recently reestablished itself there.

Baeolophus wollweberi annexus. Bridled Titmouse. A family group of at least four was seen along the San Pedro River at Feldman on May 30, 1940, and the male parent was taken by Phillips. This is a locality completely away from the usual Upper Sonoran range of the species. Phillips also saw parent titmice carrying food to the young in the nest in lower Aravaipa Canyon, about 13 miles east of the Feldman locality, on April 14, 1940. This location is mostly Lower Sonoran, with cottonwood and sycamore the dominant plant species, and with some walnut and, farther back from the stream, considerable mesquite. Possibly the species ranges down to Feldman along Aravaipa Creek.

Thryomanes bewickii. Bewick Wren. Two were noted (one singing) at Feldman on May 30. This is the lowest locality on the San Pedro River from which the species has been reported during the breeding season. It is not known to breed in the central valleys of Arizona. At least two were noted singing in lower Aravaipa Canyon, in the same place as the titmice, on April 14, 1940 (Phillips).

Telmatodytes palustris. Marsh Wren. A few were heard by Phillips at Topock on June 26, 1939, establishing a second breeding locality on the lower Colorado River north of Mexico (see Linsdale, Pac. Coast Avif. No. 23, 1936:93).

Hylocichla guttata. Hermit Thrush. Two specimens collected by Monson at Patagonia on December 3 and March 9 are referable to *sequoiensis* and *guttata*, respectively. A female collected there by Phillips on March 10 is *slevini*, and a male *auduboni* was collected by Hargrave and Phillips on the same date. This is a remarkable lot of races on these dates, when *guttata* far outnumbers all other races in most parts of eastern Arizona. The nomenclature herein is that of the 1931 A.O.U. Check-list. Comparative material used was from our own and Hargrave's collections, the Arizona State Museum, University of Arizona, and the Museum of Northern Arizona. Some of these specimens had been identified by Dr. Oberholser.

Vireo solitarius cassinii. Cassin Vireo. Three were collected at Patagonia on December 3. There is only one previous published winter record for Arizona, that of a single bird seen in lower Sabino Canyon, near Tucson, December 17, 1939, by Phillips (Bird-Lore, 42, 1940:128). The species winters at Tucson quite regularly, however, and has been noted often in December and February, 1936-1940, especially in 1939-40.

Vermivora celata. Orange-crowned Warbler. That this species winters widely in southern Arizona is substantiated by the following records: Three seen at Patagonia on December 3 (two collected by Phillips, one *celata*, the other *orestera*); one collected by Monson at Yuma on February 18 (*orestera*), and another seen by him on the Colorado River on the same date. Its wintering near Tucson and in the Baboquivari Mountains has already been reported (Phillips, Condor, 35, 1933:230; Vorhies, Jenks, and Phillips, Condor, 37, 1935:246). As yet there seem to be no midwinter records of *V. c. lutescens* in Arizona, and the report of *sordida* at Yuma is probably an error.

Dendroica aestiva sonorana. Sonora Yellow Warbler. A male collected by Monson at Patagonia on March 9 is the earliest record for the state by ten days. The next earliest is that of a male seen and a female taken by Phillips at Fort Lowell on March 19, 1939.

Dendroica coronata × *D. auduboni*. An adult male was collected by Monson at Menagers Dam on January 7. This bird has large white spots on the outer four pairs of rectrices, and white edgings on the other two pairs, but is otherwise typical *coronata*. Hybrids of these two species appear almost as commonly in Arizona as pure-blooded *coronata*.

Dendroica nigrescens. Black-throated Gray Warbler. Two females taken by Phillips on the Colorado River west of Yuma on February 18 would seem to establish that locality as within the wintering range. The specimens are typical *D. n. nigrescens*, as restricted by Oberholser (Sci. Publ. Cleveland Mus. Nat. Hist., 1, 1930:101-102), and our identification has been checked by him.

Dendroica townsendi. Townsend Warbler. A young female collected at Patagonia on December 3 is the first winter record for the state.

Oporornis tolmiei. Tolmie Warbler. Nine were seen, mostly by Monson (one male taken by Phillips), at the west base of the Baboquivari Mountains on March 24. This is a heavy migration for a date nearly a week earlier than the earliest previous Arizona records known to us.

Geothlypis trichas occidentalis. Western Yellow-throat. A male seen by the authors at Menagers Dam on January 6 and taken the next day proved to be of this subspecies, although it is unusually small. Another male Yellow-throat was seen January 7.

Geothlypis trichas chryseola. Golden Yellow-throat. Two males were taken by Phillips on May 30 at Feldman, where the species was common. We are unable to distinguish these specimens from breeding males of *chryseola* in our collections from around Tucson and Bisbee, but we do not have any certainly identified *scirpicola*. The identification of Phillips' Tucson birds has been checked by Dr. Oberholser. The authors believe that van Rossem (Trans. San Diego Soc. Nat. Hist., 8, 1936:142) has assigned altogether too much of southern Arizona to *scirpicola*, which race may not occur anywhere in central or southeastern Arizona.

Icterus parisorum. Scott Oriole. An adult male was heard singing by Monson at Patagonia on March 9 and was collected by him the next morning. This is the earliest record for the state.

Piranga flava hepatica. Hepatic Tanager. A female noted by Phillips at Patagonia on December 3, and a pair seen there by Monson on February 21, 1940, and taken by Phillips on March 9, establish the Hepatic Tanager as a wintering bird in Arizona.

Passerina amoena. Lazuli Bunting. Two males were taken at Patagonia on December 3, the first winter record for the state. Phillips (Condor, 35, 1933:230) has previously published a record of this bird in December from the west side of the Baboquivari Mountains, but since this record appears subject to some doubt, he wishes to withdraw it.

Passerina versicolor pulchra. Beautiful Bunting. Two males were seen by us on June 30, 1940, and a pair was taken by Monson on July 4, at the south base of the Santa Catalina Mountains. The male taken was singing, appeared to have established a territory, and had greatly enlarged testes; but the female did not appear ready to lay, indicating a very late breeding season. The species has not hitherto been reported north of Fort Crittenden, where a single female was taken on July 14, 1884 (Brewster, Auk, 2, 1885:198).

Oberholseria chlorura. Green-tailed Towhee. Two seen at Menagers Dam on January 6 and 7 establish that locality as within the wintering range.

Ammodramus savannarum perpallidus. Western Grasshopper Sparrow. Monson saw two at Ventana Ranch, in the northwestern part of the Papago Indian Reservation, on November 20, 1939. Phillips took a female on January 6 at Menagers Dam, which is considerably west of previously published localities for southern Arizona.

Aimophila carpalis. Rufous-winged Sparrow. Four were seen and two collected on March 24 at the west base of the Baboquivari Mountains. Moore has previously recorded its presence at Fresnal, a few miles to the north (Proc. Biol. Soc. Wash., 45, 1932:233). We wish to emphasize, however, that the Baboquivari Mountains form its eastern and not its western limit along the Mexican boundary. It has not been recorded on their eastern slopes.

Junco hyemalis connectens. Cassiar Junco. A male was collected on the Colorado River west of Yuma on February 18. There are no previously published records of this junco from western Arizona.

Junco oreganus shufeldti. Shufeldt Junco. A male was taken by Monson from a flock of about 20 mixed juncos (mostly of this race) at Menagers Dam on January 7. Another male taken from this flock by Phillips is apparently a hybrid (*oreganus* \times *hyemalis*). A female was taken from a mixed flock of ten juncos in brush along the Colorado River west of Yuma on February 18. The Yuma specimen is very pale and small (longest wing 70.5 mm., only minutely longer than the tail!), yet it is grayer above than tan, so we do not refer it to *thurberi*.

Junco oreganus thurberi. Thurber Junco. A female was collected by Phillips on March 10 at Patagonia. According to our observations, this race is by no means "abundant" (Swarth, Pac. Coast Avif. No. 4, 1904:40) in southeastern Arizona.

Junco mearnsi. Pink-sided Junco. One or two were seen by Phillips at Menagers Dam on January 7. A hybrid female (*caniceps* \times *mearnsi*) was taken by Phillips west of Yuma on February 18. Another hybrid was seen by Phillips at Patagonia on March 10. These hybrids are decidedly uncommon, though regular, in Arizona. The Yuma specimen is very pale, and appears definitely *caniceps* \times *mearnsi* rather than *caniceps* \times *thurberi*, so cannot be referred to "*Junco oreganus mutabilis*" of van Rossem (Trans. San Diego Soc. Nat. Hist., 6, 1931:329).

Junco caniceps caniceps. Gray-headed Junco. One was seen by Phillips on January 7 at Menagers Dam.

All the above-mentioned juncos, except *thurberi*, are generally believed to occur primarily in the mountains of eastern Arizona, and these records extend their ranges westward in Arizona.

Spizella atrogularis atrogularis. Mexican Black-chinned Sparrow. One was collected by Monson at the west base of the Baboquivari Mountains on March 24. This record, plus a sight record by Monson on February 10, 1935 (Condor, 38, 1936:176), constitute the only records for the Baboquivari range.

Zonotrichia leucophrys leucophrys. White-crowned Sparrow. Two adults were seen singly at Yuma on February 18. Two or three adults, and one immature with only the lores black, were seen at Patagonia on March 9, and an adult was taken there by Monson the next day. The Patagonia birds probably represent spring arrivals, since this race was not detected on December 2 or 3, nor by Monson on February 21, 1940.

Zonotrichia albicollis. White-throated Sparrow. An immature male collected by Monson at Patagonia on December 3 is the first record of the species for the state. A second record was established on April 10, 1940, when one was banded at Tumacacori Mission, north of Nogales, by Mrs. Louis R. Caywood, under permit of Mr. Caywood. The bird repeated on April 12, when the identification was verified by Mr. F. M. Dille, the well-known ornithologist, now of Nogales, and by Mr. and Mrs. John Fast, who have banded many of these birds in Illinois. Mr. Caywood, custodian for the National Park Service of Tumacacori National Monument, has kindly permitted us to publish this record.

RESUMÉ

The above data present certain points which require comment. It is, of course, obvious that records obtained in a single winter in the course of but few hours afield are not proof of regular wintering of any migratory bird. It is also true that the winter of 1939-1940 was unusually mild for Arizona. We believe that most of the records reported here will prove to represent regular periods of occurrence. The sapsucker and a very few others are the only ones which we consider more or less casual.

Ornithologists have long recognized a difference between the faunas of the mountains within fifty miles of the Arizona-Sonora border and the regions farther north. This difference exists in the breeding birds, and to our knowledge no difference of any consequence in the wintering birds has been shown heretofore. It is, therefore, of decided interest to find at least nine birds (*Tyrannus vociferans*, *Empidonax hammondi*, *Empidonax oberholseri*, *Myiochanes pertinax pallidiventris*, *Hylocichla guttata sequoiensis*, *H. g. auduboni*, *Dendroica townsendi*, *Piranga flava hepatica*, and *Passerina amoena*) apparently wintering at Patagonia but not at Tucson. Of these nine, seven have not yet been detected at Tucson in winter, and the two *empidonax* flycatchers are evidently irregular there at that season. Tucson, of course, is considerably lower and warmer than Patagonia, so temperature and altitude are not likely to prove the important factors.

Another point brought out by these records is that, despite the attentions of several collectors, the winter avifauna of the lower Colorado River is far from well-known. In the course of a few hours there, we saw *Mergus merganser*, *Dendroica nigrescens nigrescens*, *Zonotrichia leucophrys leucophrys*, and certain other birds not previously known to winter there. These westward extensions of range diminish the differences between the known winter avifaunas of Yuma and Tucson, but before conclusions can be reached the Yuma avifauna must be better known.

The number of birds that breed at Feldman but not in the valleys 60 to 90 miles farther west is of interest. *Tyrannus vociferans*, *Camptostoma imberbe*, *Baeolophus wollweberi annexus*, *Thryomanes bewickii*, and perhaps others, appear to fall in this class.

Box 1306, Albuquerque, New Mexico, and University of Arizona, Tucson, Arizona, October 30, 1940.

THE SIGNIFICANCE OF MOLT CENTERS AMONG THE SECONDARY REMIGES IN THE FALCONIFORMES

By ALDEN H. MILLER

The sequence of replacement of the secondary feathers of the wing is fairly constant in any one species of bird and often it is similar throughout larger taxonomic units. The pattern of replacement in the quail and grouse, for example, adheres to a fixed and peculiar pattern (see Salomonsen, Moults and Sequence of Plumages in the Rock Ptarmigan, 1939:35-36). Heinroth (Sitzungsber Gesell. Naturforsch. Freunde Berlin, 1898: 95-118) has illustrated several different types of sequence. The most prevalent manner among birds generally is that in which molt begins at two separate centers, one at the outer end of the series, the other at or near the inner end, the replacement progressing toward the middle of the forearm. In long-winged species additional centers may occur, but these are found also in some short-winged types. Such is true of the moderately short-winged accipitrine hawks.

A survey of molting hawks reveals that a center in the middle of the forearm is normal in the Falconiformes. This center is shown in Heinroth's diagram of *Aquila* (fig. 7, p. 101) at secondary number 5. The matter that now needs to be emphasized is that either secondary 4 or 5, and no other, initiates the molt in this part of the wing.

In the small and middle-sized members of the Accipitridae, molt begins at three points: secondary 1, 5 (less commonly 4), and 10, 11 or 12. From secondary 1 molt progresses inward toward 4; from 5 it progresses inward toward 10; and from the inner center it spreads to adjacent numbers as far outward as 9. A specimen (Mus. Vert. Zool. no. 61344) of Sharp-shinned Hawk (*Accipiter velox*), taken July 19, 1932, is especially suitable for indicating the process. This bird was molting from the brown immature plumage to the blue-gray adult plumage and therefore was a bird in its second summer. The diagram (fig. 29) shows the condition of the major wing feathers; new feathers are shaded and those that are in process of growth are represented by shorter quills. Points to be noted are (a) the usual orderly replacement of the primaries and their corresponding greater primary coverts, (b) the three centers in the secondary series at 1, 5, and 12, (c) the early replacement of the greater secondary coverts, and (d) the outward progression in the four principal feathers of the tertiary series. The carpal remex apparently had not yet been replaced, but the carpal covert was just growing in. The latter feather of course belongs to the series of greater secondary coverts.

Supporting evidence for the order of replacement which I have described was derived from the following birds that were in critical stages of molt: 2 *Astur atricapillus*; 7 *Accipiter velox*; 1 *Accipiter nisus*; 4 *Accipiter cooperii*; 3 *Buteo swainsoni*; 1 *Buteo solitarius*; and 2 *Circus hudsonius*.

In the eagles and larger hawks the replacement of secondaries is comparatively irregular, as also in the Cathartidae. Apparently it is not uncommon for individuals to fail to molt all the secondaries in a single year. However, when there is replacement, almost invariably there is activity beginning at secondary 4 or 5, and if the process is carried far, it usually follows the pattern found in *Accipiter*. The chief irregularities consist of the molt spreading outward from 4 and 5 as well as inward, and of occasional extra centers toward the inner end of the series at 8 or 9. Among molting Red-tailed Hawks (*Buteo borealis*), fifteen showed a center at secondary 5, and seven at secondary 4.

In the falcons and caracaras (Falconidae) the molt program differs from that in the Accipitridae in that activity centering at secondary 1 is retarded and may in effect

be suppressed. The molt beginning at secondary 4 or 5 regularly spreads outward as well as inward, and secondaries 1 and 2 fall after 3. In this connection it is noteworthy that the primary molt in falcons does not begin with 1, but at a point farther out in the series. The following molting falconids were examined: 12 *Falco sparverius*; 1 *Falco columbarius*; 1 *Falco albicularis*; 1 *Falco peregrinus*; 1 *Falco mexicanus*; 2 *Polyborus cheriway*.

As a result of Steiner's (Jenaische Zeitsch. Naturwiss., 55, 1918:221-496) exhaustive investigation of the subject of diastataxy, it is known that the series of secondary remiges is a composite of two embryonic groups of feathers in both eutaxic and diastataxic birds. The four outer secondaries belong to the same longitudinal row of embryonic feathers as the greater under coverts of the proximal part of the forearm, and accordingly the inner secondaries correspond to the greater upper coverts of the distal forearm. In the embryo the distal parts of the longitudinal feather rows shift around the angle of the posterior margin of the wing, moving toward the dorsal surface. Continuous longitudinal rows are reformed by the joining of nonidentical rows at the point where differential movement has taken place. At this point of junction in diastataxic birds, namely, between the fourth and fifth secondaries, an extra greater covert is retained, without a secondary feather to match it. The Falconiformes are diastataxic and this extra covert is always to be found (see fig. 29).

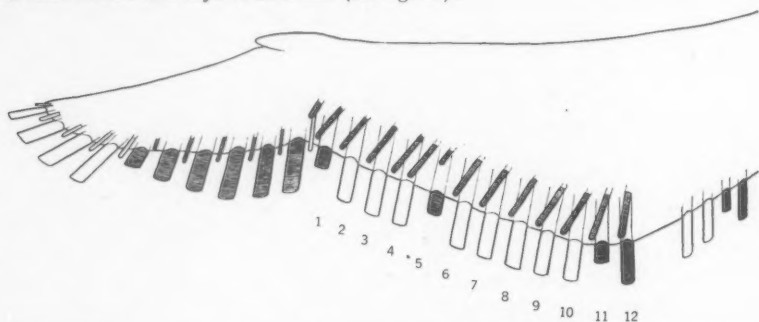


Fig. 29. Dorsal surface of left wing of Sharp-shinned Hawk (Mus. Vert. Zool., no. 61344), showing molt of remiges and greater coverts. Secondaries are numbered. Shaded quills represent new feathers, white quills old feathers, and short quills those which are growing.

In the author's study of secondary molt in shrikes (Univ. Calif. Publ. Zool., 30, 1928:410-415) it was found that the two molt centers, inner and outer, frequently spread to meet in the region of secondary 5. It was noted that this was suggestive of the two separate embryonic rows that joined at this point to make the definitive series of secondaries. The special significance of a constant molt center in Falconiformes at secondary 4 or 5 lies in its localization exactly at the diastataxic break. It may be supposed that there is some regulating device within each of the series of major flight feathers that induces molt to proceed, one or two feathers at a time, beginning at one or both ends of the series. It is entirely to be expected that the disturbance at the diastataxic point would supply, so to speak, a broken end of a chain of feathers, and as such it would be susceptible to whatever internal stimulus initiates molt in series of flight feathers.

The occurrence of more than two molt centers in the secondary remiges has been regarded as an adjustment accompanying great elongation of the middle segment of the

wing. Whether elongation in the Falconiformes was in some way the cause of a new center which became focused at the diastataxic break, or whether the center merely occurs as a reflection of an embryonic situation cannot be determined. There is evidence in the true falcons that a shorter wing, with more crowded secondaries, leads to reduction in centers. But in these birds the diastataxic center persists and the center at the wrist is suppressed.

The wrist region, for both primaries and secondaries, is especially crowded in shortened wings. It appears likely that crowding tends to retard molt just as pressure of structures beneath the skin tends to reduce or eliminate feather growth (see Burt, Univ. Calif. Publ. Zool., 30, 1929:434). In the short wings of quail, secondaries 1 and 2 always molt after the remainder of the series. Further support for this generalization is seen in the delay in replacement of the crowded, vestigial carpal remex in the angle of the wrist joint (fig. 29) in *Accipiter*, and the lag in growth of the carpal covert and of one of the greater secondary coverts which occurs at the crowded point in this series of feathers in the diastataxic region. The comparative freedom of terminal members of series of remiges, perhaps resulting in better blood supply, may conversely be the reason for the molt starting with these members. Secondaries 4 and 5, which are slightly farther apart and less crowded than the other secondaries may enjoy a similar advantage.

Once a remex has started to grow, the greatly increased vascularization of growth should somewhat increase the blood supply of adjacent feathers in the row. By this means the next feather germ may be stimulated. If the threshold of reaction of feather germs to a general internal stimulus is prevalingly high, and assuming that the stimulating agent (possibly thyroxin; see review by Salomonsen, *op. cit.*, 388-393) is received through the blood stream, only certain feather germs that are well vascularized to begin with would respond. They would constitute molt centers. From them, by means of increased local vascularization, a wave of induction would pass along the series of feather germs.

Museum of Vertebrate Zoology, Berkeley, California, February 23, 1941.

FROM FIELD AND STUDY

A Unique Nesting Site of the Western Wood Pewee.—In my garden at Okanagan Landing, British Columbia, in July, 1940, a pair of Western Wood Pewees (*Myiochanes richardsonii richardsonii*) selected a nesting site that was thought to be unique. This was a double wrap of burlap placed around a young quince tree and its supporting stake three feet above the ground. It happened that the material had been tied in such a manner as to form a hammock-like structure open at the top, closed at the bottom, and about three inches in diameter. The bottom of the nest filled this space.



Fig. 30. Nest of Western Wood Pewee on burlap support.

In this locality the Western Wood Pewee commonly builds a compact, sometimes lichen-covered, nest on a horizontal branch. Usually cottonwood down and horsehair are important constituents and often the outside is well coated with cobweb. This particular nest was loosely made of fine, dry grass to which had been added one small piece of string, three pheasant feathers and a very small amount of cobweb.—J. A. MUNRO, *Okanagan Landing, British Columbia, December 30, 1940.*

A Winter Record of the Bullock Oriole for Butte County, California.—Bullock Orioles (*Icterus bullockii*) are common summer visitors in Butte County, California, but usually the only reminders of them in the winter are the many gracefully swinging, cup-shaped nests to be counted by the dozens when the leaves have fallen. On January 29, 1939, a male of this species was observed at Durham, Butte County, whereupon the writer learned the value of a "bird in the hand" in reporting unusual observations. On December 24, 1940, a male was seen again; it was watched from a distance of fifteen feet for ten minutes while it fed on persimmons. The bird was seen repeatedly during the next four days, both near the persimmon tree, and upon a hawthorn tree two blocks away, where it ate the hawthorn berries. It was collected on December 29, 1940, and the skin was placed in the collection of Chico State College. No other orioles have been seen since in this vicinity; however, another of the species has been reported on the Walker ranch, three miles east of Durham. The orioles regularly arrive in this locality in the second week of April. Even then they are almost never seen in the town, but are common in the surrounding country.—E. G. ENGLAND, *Durham, California, January 12, 1941.*

Leconte Sparrow in Utah.—In studying a collection of Utah birds, I am reminded of collecting a Leconte Sparrow (*Passerherbulus caudactus*) near Utah Lake south of Provo, Utah, on December 24, 1927. The specimen is now no. 416 in the collection of Brigham Young University, and I

believe is the only specimen of the species taken in Utah.—CLARENCE COTTAM, *Fish and Wildlife Service, Washington, D. C., December 2, 1940.*

Western Ruby-crowned Kinglet Nesting in the San Bernardino Mountains.—A nest of the Western Ruby-crowned Kinglet (*Corthylio calendula cineraceus*) was discovered on May 19, 1940, by seeing a bird take nesting material to it. The location was nineteen feet from the ground and near the end of a downward-sloping branch of a large silver fir tree on a hillside south of Big Bear Lake, San Bernardino Mountains, California, at an elevation close to eight thousand feet. On June 2, 1940, the nest contained eight fresh eggs. The weights of these in grams were (1) 0.71, (1) 0.68, and (6) 0.66. This is possibly only the second actual nesting record for this species in the San Bernardino Mountains.—WILSON C. HANNA, *Colton, California, June 4, 1940.*

Arboreal Nests of the Gambel Quail in Arizona.—That a Gambel Quail (*Lophortyx gambelii*) would build a nest high up in the top of a large tree seemed to the writer almost unbelievable until one was actually seen and photographed. Referring to the published literature, it is found that Bent (U. S. Nat. Mus. Bull. No. 162, 1932:76) in summarizing the nesting of the species mentions records of three nests at heights of five feet above the ground. Harry L. Crockett and Ruth Crockett (Condor, 38, 1936:97-99) wrote of tree-nesting quail studied and photographed on the Stannard ranch near Phoenix, Arizona, during the summer of 1935.

After the writer had drafted a manuscript covering the recent observations reported here, it was discovered that the Crocketts had done likewise; they have generously deferred to the writer and made their notes available to him.



Fig. 31. Tamarisk tree in which Gambel Quail nested. Black cross slightly to right and above center of tree marks site.

Glynn and Carlos Stannard, brothers, operate adjoining citrus groves about nine miles northeast of Phoenix, Arizona, near Camelback Mountain; Carlos Stannard is an alert bird student and active bird bander. Overhanging the Glynn Stannard ranch home is a handsome evergreen tamarisk tree, probably *Tamarix articulata*. In 1938 this tree had grown so tall and top-heavy that it was topped back severely; limbs that were fully 12 inches in diameter were sawed through. By the summer of 1940 new growth from about the margins of the old cuts had reached heights up to 20 feet, and the entire rim of the old cut surfaces was built up by scar growth until in the center a perfect basin resulted.

On May 18, 1940, a pair of White-winged Doves (*Melopelia asiatica*) had for some time worked actively at nest building in this tree and Carlos Stannard climbed the tree to search for their nest. To his surprise a nest of Gambel Quail containing 12 eggs was found in one of the old cuts high up in the tree; the nest consisted of one of the basin-like depressions already described, with a thick lining of dead leaflets of the tamarisk and numerous quail feathers. On discussing the nest with members of his brother's household, he found that only a few days before an adult quail had been taken away from the family cat at the foot of this tree and that the quail had flown away, apparently not seriously harmed.

The quail never returned to the nest, and it was inferred that the owner of the nest had been the same quail rescued from the cat. When the writer photographed the nest several days later, it was necessary to reverse the eggs, since cactus wrens or other birds had pierced each one. Figure 31 shows the tree, the approximate location of the nest being marked with an "x"; figure 32 is of the nest and eggs, taken from directly above. By actual tape-line measurement, the nest was twenty-seven feet, six inches, above the ground.

Other moderately high quail nests have occurred in and adjacent to the Stannard groves since 1935. In June, 1936, on an adjoining property, a nest seven feet high in an umbrella tree was reported

to the Stannards and the Crocketts; this nest was close to a bedroom window, and apparently the people frightened the birds away because of the quails' early morning chatter.

Another nest in the Glynn Stannard grove was seen by the writer; this one was in a grapefruit tree between eight and nine feet from the ground in an abandoned thrasher's nest; 14 eggs had hatched safely. Another nest was built in vines over a porch but apparently was deserted, and since the vines were thick no inspection was made.



Fig. 32. Quail nest in tree shown in figure 31.

On the Carlos Stannard lawn is another tamarisk tree in which the two main branches have split apart, leaving a circular space several inches wide and fully 18 inches deep at the center. In June, 1940, a quail occupied the more-or-less circular cavity, about eight feet from the ground. After 11 eggs were laid, Stannard noticed that three of them were pierced. He carefully removed the broken eggs and the quail laid three more, leaving a completed clutch of 11 eggs.

The brood of the nest in the grapefruit tree apparently reached the ground safely, their descent being made fairly easy by the thick branches and leaves below the nest through which they could slide. The brood of 11 from the split-tamarisk nest apparently got down successfully. However, it is extremely interesting to ponder just how the young from the nest high up in the big tamarisk could have reached the ground safely, had they hatched.—JOHNSON A. NEFF, *Fish and Wildlife Service, Sacramento, California, September 27, 1940.*

New and Additional Nevada Bird Records.—The following notes pertain to new and additional records of birds for the state of Nevada. These observations and specimens were all taken in Churchill County which is situated in the west-central part of the state. Unless otherwise noted observations were made and specimens were obtained by the writer.

Ardea herodias hyperonca. California Great Blue Heron. One specimen was obtained (no. 78987, Mus. Vert. Zool.) four miles west of Fallon on November 13, 1939. This is the first record of this race of heron for the state.

Dendrocygna bicolor. Fulvous Tree-duck. One specimen was taken (no. 1929, Coll. J. R. Alcorn) by Mr. William Fisher, from a flock of about twenty birds, along the Carson River, 14 miles west of Fallon on November 14, 1940.

Melanitta deglandi. White-winged Scoter. One was obtained (Coll. Wm. A. Powell, Jr.) by Mr.

Hans Lammel from a flock of about fifteen birds at Carson Lake, 10 miles south-southeast of Fallon on November 3, 1940. The head and wings of a White-winged Scoter (no. 1928, Coll. J. R. Alcorn) were picked up from the highway $\frac{1}{2}$ mile south-southwest of Fallon on November 12, 1940. They appeared to have been freshly cut from the bird, possibly by some hunter who thought the duck was a protected species and wished to conceal its identity. This species of duck has not been previously reported from Nevada.

Melanitta perspicillata. Surf Scoter. Two Surf Scoters were seen and both taken (nos. 80608, 80609, Mus. Vert. Zool.) by Ward C. Russell from Soda Lake, 4000 ft., Churchill County, Nevada, on October 19, 1940. Another was taken (no. 1903, Coll. J. R. Alcorn) at Soda Lake on November 12, 1940. These are the first records of this duck in Nevada.

Squatarola squatarola. Black-bellied Plover. One was obtained by Vernon L. Mills (Coll. Mrs. Anna Bailey Mills) at Soda Lake on September 25, 1940. Another individual was observed by Mr. Mills at the same place on September 27, 1940. These are the first records of this bird from this section of the state.

Eupoda montana. Mountain Plover. One was obtained (no. 1918, Coll. J. R. Alcorn) from the Carson Lake pasture, 12 miles south-southeast of Fallon on November 15, 1940. Two specimens were taken (Coll. Mrs. Anna Bailey Mills) by Vernon L. Mills from the Carson Lake pasture on November 6, 1940. Over fifty of these plovers were seen by Mr. Mills on this date. These are the first records of this bird in Nevada.

Columba fasciata fasciata. Band-tailed Pigeon. One was seen and taken (no. 80590, Mus. Vert. Zool.) four miles west of Fallon on October 17, 1940. This is the first record for this bird in Nevada.

Ixoreus naevius meruloides. Varied Thrush. One was taken (no. 1874, Coll. J. R. Alcorn) four miles west of Fallon on November 3, 1940. Another was obtained (Coll. Mrs. Anna Bailey Mills) by Vernon L. Mills, $3\frac{1}{2}$ miles west-southwest of Fallon, on December 29, 1940.—J. R. ALCORN, *Rt. 1, Box 19a, Fallon, Nevada, January 5, 1941.*

Townsend Solitaire in Santa Cruz County.—After looking through the literature and comparing notes with Clark P. Streator, I believe that a female Townsend Solitaire (*Myadestes townsendi*) taken by me is the first record, or at least one of the very few records, of this bird in Santa Cruz County. It was taken on February 15, 1939, about two miles northwest of Corralitos along the new Rider road. This spot is at an elevation of 650 feet and is deep in the coast redwood-Douglas fir belt of this part of the county.—ALBERT C. HAWBECKER, *Watsonville, California, December 3, 1940.*

Williamson Sapsucker in Monterey County, California.—Winter records of Williamson Sapsuckers (*Sphyrapicus thyroideus thyroideus*) if plotted on a map of California would form a crescent, beginning with the Siskiyou Mountains in the north, running south through the Sierras and extending southwest to San Diego. The only record in west-central California is from Santa Cruz (McGregor, *Pac. Coast Avif.* No. 2, 1901:8). A recent occurrence 50 miles south of Santa Cruz seems worth recording. While collecting in the Santa Lucia Mountains of Monterey County on November 23, 1940, I took a male at 3700 feet. The exact locality is known as Big Pines, 9 miles west of Jamesburg. Big Pines is one of several islands of large yellow pines, surrounded by chaparral, which occurs on the northern peaks of the Santa Lucia range. The specimen is now deposited in the collections of the Museum of Vertebrate Zoology (no. 80636).—WARD C. RUSSELL, *Museum of Vertebrate Zoology, Berkeley, California, January 17, 1941.*

Lewis Woodpecker Migration.—On September 4, 1940, six Lewis Woodpeckers (*Asyndesmus lewis*) were seen flying due south over the Big Creek Experimental Unit of the California Forest and Range Experiment Station, Trimmer Springs, Fresno County, California. On September 9, 1940, another group of twenty-three of these woodpeckers flew south along the same route. Six days later, September 15, a flock of about fifty woodpeckers followed the others.

These observations are of particular interest when considered in relation to those of Clarence F. Smith (*Condor*, 43, 1941: 76). Smith's observations and mine were both made on nearly the same dates, indicating that the stimulus causing the migration was effective at widely separated localities at the same time.

There was no apparent formation in the mass flight of these woodpeckers. Instead, they passed over in straggly groups of two to fifteen individuals. Some of them flew within a few feet of each other and others flew as much as several hundred feet apart. All traveled in a relatively straight line and none was seen to stop. They flew at various altitudes, but none flew lower than an estimated 150 feet above the hilltops. Others were so high that they were almost out of sight.—LOWELL ADAMS, *Fish and Wildlife Service, Sanger, California, January 22, 1941.*

Notes on the Birds of Sitka and Vicinity, Southeastern Alaska.—The only complete report treating specifically of the birds of the Sitka region, Alaska (Baranof, Chichagof and Kruzof islands), is that by Willett (Condor, 16, 1914: 71-91). In this excellent paper 152 forms are listed and a full bibliography is given. In 1915 W. W. Brown collected in the Sitka region for two months or more, but the results of his work have been but scantily reported on. In 1920 A. M. Bailey visited the region for three weeks, in the course of which he added nine forms (Auk, 44, 1927: 1-23, 184-205, 351-367) to Willett's list.

Since 1928 the writer has been a resident of Sitka. He has been interested in birds throughout this period, although effective ornithological work was done only in 1940, from February to September. The following notes are offered as a supplement to Willett's and Bailey's lists, which omitted most of these forms, or failed to give complete data, largely because the observers were not in the region throughout the year.

Colymbus auritus. Horned Grebe. Common migrant; winters in small numbers. In 1940 seen many times from February 29 to May 1, and on September 4.

Branta canadensis minima. Cackling Goose. Flocks were seen by Bailey in May and October. The only bird seen by the writer was secured; it was a male, from Port Krestof, Kruzof Island, taken April 30, 1940.

Branta nigricans. Black Brant. In April, 1933, a large flock was seen near Port Krestof, Kruzof Island. In 1940 the species was noted several times: two birds were noted in Olga Strait on February 28; two on the Indian River flats on April 18; a flock of twenty in Port Krestof from April 30 to May 2; a flock of twenty near Fred's Creek, Kruzof Island, on May 4.

Chen hyperborea hyperborea. Lesser Snow Goose. Regular migrant. A flock of eight was flushed from the Indian River flats the morning of May 10, 1940; flocks passed over Sitka, flying east, on May 29, May 30, and May 31, 1940.

Mareca americana. Baldpate. Common spring migrant; rare in the fall. In 1940 it was seen several times from April 16 to May 1, and on August 4.

Glaucionetta islandica. Barrow Golden-eye. Winters in large numbers, but is usually less plentiful than the American Golden-eye. Seen as late as May 17 in 1940.

Buteo lagopus s. johannis. American Rough-legged Hawk. Taken at Sitka by Bischoff (Dall and Bannister, Trans. Chicago Acad. Sci., 1, 1869: 351-367). Noted in 1940 as follows: two on Mt. Verstovia on April 8; one over Sitka Bay on May 7; one over Sitka on June 2; one over Baranof Point on July 26.

Phasianus colchicus. Ring-necked Pheasant. A considerable number of birds was introduced near Sitka in 1933 and 1934. At present a few pheasants are left in the swamps on the outskirts of the town. A brood of immatures was flushed on July 10, 1940.

Oxyechus vociferus. Killdeer. One seen at close range on the Sheldon Jackson School campus, August 15, 1937; one on the Indian River flats, April 11, 1940; and two on the Indian River flats on August 29 and 30, 1940.

Calidris canutus rufus. American Knot. A specimen was taken at Sitka by Bischoff (Dall and Bannister, loc. cit.). A flock of eight birds was seen by the writer at Port Krestof on April 30, 1940.

Arquatella ptilocnemis ptilocnemis. Pribilof Sandpiper. The only previous record from southeastern Alaska consists of specimens from Lynn Canal reported by Hartlaub (Jour. für Orn., 31, 1883: 257-286). Three specimens referable to this race were taken by the writer in 1940 as follows: a male on April 1 (Fuertes Memorial Coll., at Cornell University, no. 7361); a female on April 17 (no. 9210); a male on May 7 (no. 7701).

Arquatella ptilocnemis couesi. Aleutian Sandpiper. Common in winter and spring. Specimens were taken in March, April and May.

The species *Arquatella ptilocnemis* was common in 1940 until May 10; on July 25 a single bird in breeding plumage was seen in a mixed flock of shore birds on a rock near Povorotni Point, Baranof Island.

Pelidna alpina sakhalina. Red-backed Sandpiper. Common migrant; occasionally winters. Specimens were taken at Sitka by Bischoff (Dall and Bannister, loc. cit.). In 1940 the species was common from April 26 to May 16 and was also noted March 6 (three birds at Sitka) and July 24.

Ereunetes mauri. Western Sandpiper. Abundant migrant; evidently winters occasionally. In 1940 the large flocks arrived on April 25, but three were observed previously, on March 8. They were watched for half an hour through a powerful telescope at a range of twenty-five yards or less, feeding in a mixed flock of shore birds at Sitka.

Larus argentatus thayeri. Thayer Gull. Common wintering bird, as noted by Willett (Condor, 25, 1923:26) at Craig and Wrangel. A female taken by the writer on March 28, 1940 (no. 7353), has the short slaty wing tipplings and the dimensions that characterize this subspecies.

Zenaidura macroura. Mourning Dove. A male Mourning Dove taken by Merrill on September 14, 1912, was recorded by Willett as *Z. m. marginella*. The species has been seen at Sitka by the writer only once—a single bird that loitered about the Sheldon Jackson School campus for several hours on September 9, 1940.

Nucifraga columbiana. Clark Nutcracker. A single specimen was taken by Bischoff at Sitka (Dall and Bannister). One was seen about the houses of Sitka for several days in March, 1933. In April of the same year a lone individual was noted three miles south of town.

Nannus hiemalis pacificus. Western Winter Wren. Common resident. Noted daily from February 26 to September 7 in 1940; a specimen was taken on July 25; it was a juvenile about ready to leave the nest.

Acanthis linaria linaria. Common Redpoll. Several specimens were taken by Bischoff. A single redpoll was found dying on a road near Sitka in January, 1930.

Passerella iliaca unalaschkensis. Shumagin Fox Sparrow. Large gray fox sparrows were noted at sea level near Sitka on September 6 and 7, 1940. One was secured and proved to be a female of this race (no. 9211).—J. DAN WEBSTER, *Laboratory of Ornithology, Cornell University, Ithaca, New York, January 14, 1941.*

American Egret, Treganza Heron, and Ring-billed Gull at Malheur Lake in Winter.—On December 21, 1939, in the vicinity of Malheur Lake, Oregon, fourteen American Egrets (*Casmerodius albus egretta*), eight Treganza Herons (*Ardea herodias treganzai*) and one Ring-billed Gull (*Larus delawarensis*) were recorded along with other waterfowl. A number of the egrets were seen with large flocks of Whistling Swans feeding in the shallow waters near the southeastern shore of Malheur Lake. The egrets and herons appeared to be having a hard time keeping warm and did little flying or wading. Many of the herons were standing humped up on top of muskrat houses. The maximum temperature during the day was 40° F.; prior to December 21 the lowest maximum daily temperature recorded in the fall was 36° F. The minimum temperature prior to that date was 10° F. In general the weather had been mild. On the night of December 22 it became colder, and until December 26 the maximum daily temperatures remained freezing or below and the minimum temperature was 4° F. On December 27, in the course of a trip around the lake, no egrets were seen, and only one Treganza Heron was noted with the other waterfowl.

Several herons were observed on a number of occasions in the Blitzen Valley, which is part of the Malheur Refuge, in each of the succeeding winter months. The birds evidently wintered there fairly successfully.

The above records are interesting inasmuch as the latest date recorded for the American Egret in Oregon by Gabrielson and Jewett (*Birds of Oregon*, 1940: 107) is November 19. They list the Treganza Heron as wintering regularly in Deschutes, Malheur, Klamath, Wasco, and Umatilla counties, and they give casual winter records for Crook, Grant, Union, Baker, Wallowa, and Morrow counties. It may be that the Treganza Herons have wintered in the Blitzen Valley in the preceding mild winters. The Ring-billed Gull was probably a stray, as the gulls normally leave Malheur Lake much earlier in the season.—CLARENCE A. SOOTER, *Fish and Wildlife Service, Burns, Oregon, December 26, 1940.*

Elderberries as Food for Birds.—In June of 1940, I was camped on Rattlesnake Island in Clear Lake, Lake County, California. While there, I saw many birds feeding on elderberries. These included Red-shafted Flickers (*Colaptes c. collaris*), Downy Woodpeckers (*Dryobates p. turati*), Nuttall Woodpeckers (*Dryobates nuttalli*), Western Kingbirds (*Tyrannus verticalis*), Ash-throated Flycatchers (*Myiarchus c. cinerascens*), California Jays (*Aphelocoma c. immanis*), Plain Titmice (*Baeolophus i. inornatus*), Yellow Warblers (*Dendroica a. brewsteri*), Long-tailed Chats (*Icteria v. longicauda*), Bullock Orioles (*Icterus bullockii*), Black-headed Grosbeaks (*Hedymeles m. maculatus*), and Spotted Towhees (*Pipilo maculatus*, subsp.?). Of this group, the California Jay most frequently visited the elderberries. The next most frequent visitors were the Bullock Orioles and the Spotted Towhees, in that order. The other birds named were seen to eat the berries only once or twice.

Of the birds living on the island, the Song Sparrows and Yellow-throats were much more numerous than any of the other birds. Spotted Towhees and California Jays came next. The Bullock Orioles, although apparently not residents, flew to the island from the mainland about one-quarter to one-half mile away, and were seen eating the elderberries more often than the resident towhees. The orioles were not seen eating the berries as often as the jays, but there were more of them at one time and their total consumption was probably greater.

The only birds identified as juveniles which fed on the elderberries were orioles and jays.—NED W. STONE, *Berkeley, California, November 10, 1940.*

Indigo Bunting and Band-tailed Pigeon in Utah.—In the course of field work in 1940 the writer encountered Band-tailed Pigeons (*Columba fasciata*) and an Indigo Bunting (*Passerina cyanea*) in southern Utah. Because of the paucity of published records for these species in the state, the occurrences are worthy of formal mention. It seems that but one record of the bunting and four of the pigeon have been published for Utah. The bunting was considerably outside of its normal range and its occurrence probably can be regarded only as accidental. Although the pigeon in the past has probably been largely overlooked in the state, it is doubtful that it has ever been abundant anywhere in Utah. The birds here listed were seen in game preserves or other restricted areas where collecting was not permitted. However, to one familiar with them, their distinctive color pattern and habits almost preclude the possibility of confusion with other species.

One adult male Indigo Bunting was seen at a distance of about 50 feet at the mouth of Zion Canyon at the entrance of Zion National Park, July 21, 1940.

From evidence obtained, it appears that the Band-tailed Pigeon is an annual summer resident in the mountains, at least, in the southern part of Utah. More than twenty individuals were seen on July 24, 1940, at close range (two were within 30 feet) at Oak Grove and Bitter Creek Canyon on the south slope of Pine Valley Mountain. One individual was believed to be a bird only recently out of the nest. Reports from guides and park service officials at Zion Canyon give evidence that at least one flock spent the summer on the rims or high plateaus adjacent to Zion Canyon.

Junior Refuge Manager W. G. McFarland of the Bear River Migratory Waterfowl Refuge reports that in June, 1939, he saw a flock of Band-tailed Pigeons at Buckboard Flat, Blue Mountains, San Juan County, Utah, at approximately 8000 feet elevation. The birds occurred in a yellow pine association.

Mr. Lee Griner, a graduate student at the Utah Agricultural College, reports seeing three flocks of pigeons on August 18, 1937, at Blue Mountain, 8 miles west of La Sal, Utah. Two flocks of 23 and 9 birds, respectively, were found in the vicinity of North Creek at an elevation of 8200 feet, while the other flock of 57 birds was observed a mile east of North Creek at an elevation of about 7800 feet. Mr. Griner saw the birds and found their nests in June, 1937, at Oak Grove, Pine Valley Mountains. He also obtained evidence from local residents that the birds had occurred there during the summers for at least six preceding years. In the summer of 1937 a competent local observer reported seeing pigeons at about 9000 feet elevation near the town of Pine Valley on the north slope of the Pine Valley Mountains. In June, in the years 1931 and 1932, sizable flocks of these birds are said to have caused considerable damage to a small cherry orchard at New Harmony on the east slope of the Pine Valley Mountains. Oscar Deming, a graduate student at the Utah Agricultural College, gave further evidence of the birds in the Pine Valley Mountains; he states that in 1937 they frequented the mountain from the middle of May until October. He counted 28 pigeons at one time in one dead western yellow pine.—CLARENCE COTTAM, *Fish and Wildlife Service, Washington, D. C., December 10, 1940.*

NOTES AND NEWS

Members of the Cooper Ornithological Club are reminded of the Fifteenth Annual Meeting, which is to be held in Berkeley, California, on April 11 and 12, 1941. Compilation of the scientific program must be finished shortly after the appearance of this issue of the Condor. Members who plan to appear on the program should, therefore, transmit titles of their papers to the Committee on Arrangements without delay. The field trip to the Los Baños region in Merced County, planned for Sunday, April 13, should make possible the participation of many southern members who will be returning to the Los Angeles area by automobile.

We are happy to learn that Mr. Jean Delacour has been able to come to this country following his disastrous losses in France this last year. He is now serving as consultant to the New York Zoological Society, where his experience in aviculture should be of inestimable value.—A.H.M.

For some time we have been aware of an ill-advised practice followed in some journals in the titling of illustrations. Either through lack of details, or sometimes through seemingly deliberate ambiguity, the reader is allowed to make incorrect inferences about places where pictures were taken. Examples may be found in *The Audubon Magazine* (née *Bird-Lore*). In the November-December issue for 1940 on page 496 appears a photograph introducing an article by Ira N. Gabrielson on bird concentrations in Alaska. This picture apparently was supplied by the magazine to supplement the illustrations submitted by the author. The picture in question is one taken at Point Reyes, Marin County, California, and shows murre and cormorants. The photographer, Laidlaw Williams, is credited, but the legend reads: "Cormorants were present in numerous small groups, but Murres were everywhere along the hundreds of miles of rockbound coast of Alaska." The inference is natural that the birds pictured were in Alaska unless one is familiar with Mr. Williams' activities or unless one has come to know in detail the spot which is shown, as some of us have in this instance.—A.H.M.

The San Bernardino Chapter of the Cooper Ornithological Club has been meeting regularly through the past winter months, and with good attendance. Mr. Oscar F. Clarke, the secretary, reports that recent speakers before the group

have been James B. Dixon, Edmund C. Jaeger, and John B. Treudje.

We learn with interest of a California convention of the Audubon Society planned for May 10 and 11, 1941, at Asilomar, Monterey County. Mr. Bert Harwell, California representative of the Society, will be able to supply interested ornithologists with further details about this meeting. We look forward with pleasant anticipation to this first state-wide gathering of the Society.—A.H.M.

MINUTES OF COOPER CLUB MEETINGS

SOUTHERN DIVISION

NOVEMBER.—The monthly meeting of the Southern Division of the Cooper Ornithological Club was held at the Los Angeles Museum on Tuesday, November 26, 1940, with Vice-president Hildegard Howard in the chair and 23 members and guests present.

The minutes of the October meeting of the Southern Division were read and approved. Four applications for membership were read, as follows: Dorothea B. Fox, 1035 W. 35th St., Los Angeles, and Robert L. Rutherford, 4415 Victoria Park Dr., Los Angeles, proposed by Frances L. Cramer; Sally Carrighar, Room 302, Montgomery Block, San Francisco, by Joseph S. Dixon, and Franklin French, Rolling Hills, California, by Blanche Vignos.

Letters were read regarding the forthcoming meeting of the Pacific Division of the American Association for the Advancement of Science, at Pasadena, California, June 16-21, 1941. The Chair appointed, as a committee to consider advisability of Cooper Club participation in this meeting: Loye Miller, Chairman, George Willett and Sherwin F. Wood. Owing to the fact that the last Tuesday in December comes on New Year's eve, it was voted to hold the December meeting of the Southern Division on Tuesday, December 17.

The speakers of the evening were Mr. J. Fred Wornus and Mr. Dwight Ryerson, Department of Zoology, University of California at Los Angeles, who gave an illustrated preliminary report on the occurrence of blood parasites in local birds.

Parasitization was found in 63 per cent of one group of birds, many new host records being among those listed. Of the birds examined, towhees, thrashers and California Jays were most heavily parasitized.

Mr. C. B. Harwell spoke briefly on projected work of the Audubon Society in California.

Adjourned.—GEORGE WILLETT, *Acting Secretary*.

NORTHERN DIVISION

NOVEMBER.—The regular monthly meeting of the Northern Division of the Cooper Ornithological Club was held on Thursday, November 28, 1940, at 8:00 p.m., in Room 2503 Life Sciences Building, Berkeley, with Vice-president E. Lowell Sumner, Jr., in the chair and about 60 members and guests present. Minutes of the Northern Division for October were read and approved. Mr. Ira La Rivers (President Nevada Audubon Society), P. O. Box 1493, Reno, Nevada, was proposed for membership by Jean M. Linsdale.

Mr. Alden Miller showed the poster provided by the National Audubon Society to call the attention of sportsmen and farmers to the value of the White-tailed Kite, a project which has been furthered through the efforts of Mr. James Moffitt.

It was suggested by Mr. Miller that Dr. Pain-ton might enjoy an expression of good wishes from the club during his convalescence, and it was unanimously decided that a letter be sent.

Mrs. Kelly spoke of the abuses again being practiced by the feather industry, in spite of protective legislation, and said that an "indignation meeting" held by the National Audubon Society and attended by representative milliners and others concerned had been successful. It is desirable that women write to leading department stores protesting the illegal traffic in plumage. The Vice-president suggested that a deluge of letters from individuals might be more effective than group action by the club. The matter was referred to the Conservation Committee for recommendations.

Mr. Rodney B. Radford, photographer with the Division of Visual Information in the U. S. Soil Conservation Service, introduced the film entitled "The Heritage We Guard." This picture presents the story of the vast resources of the North American continent, their exploitation with its frequently tragic effects, and the enlightened attempts at restoration and conservation. The sound track included a number of bird songs recorded by Dr. Arthur A. Allen.

Adjourned.—FRANCES CARTER, *Recording Secretary*.

DECEMBER.—The regular monthly meeting of the Northern Division of the Cooper Ornithological Club was held on Thursday, December 19, 1940, at 8:00 p.m., in Room 2503 Life Sciences Building, Berkeley, with Mr. Alden H. Miller presiding and about 60 members and guests present. Minutes of the Northern Division for November were read and approved. Names proposed

for membership were: Sara Whitman Cleary, 2322 Shattuck Avenue, Berkeley, and Mrs. Ethel R. Richardson, 900 Hildale Avenue, Berkeley, both by May Titus; Robert Winthrop Storer, 2420 Channing Way, Berkeley, by Frank G. Watson.

Mrs. Kelly reported for B. C. Cain, chairman of the Conservation Committee, on the matter of illegal traffic in plumage for millinery purposes. She said that the passing of a resolution by the club and the sending of a copy to the National Audubon Society would be desirable in order that the number of organizations opposed to the trade might be recorded. Mr. Moffitt requested reading of the resolution passed by the Audubon Society of the Pacific, and a motion that the resolution be adopted as read was unanimously carried. (A copy of the resolution, with slight rewording appropriate to the Northern Division of the Cooper Ornithological Club, has been sent to the National Audubon Society; copy filed with minutes of this meeting.)

A motion was unanimously carried, authorizing the president to appoint a committee of three to nominate officers of the Northern Division for the coming year.

Mrs. Allen reported the occurrence of an Arctic Tern at Carmel, October 9, and Frank Watson added a record for the Berkeley Aquatic Park in August. Mrs. Kelly said that an Audubon Warbler had been frequenting the syrup vials put out for hummingbirds by Mrs. Hamilton in Alameda. Mrs. Allen cited the use of sapsucker holes by Audubon Warblers, and said that Mrs. Hamilton's experience makes it probable that the warblers actually take the sap and not just insects which have been attracted to it. Joe Marshall had observed some strange behavior of salt-marsh Song Sparrows and other marsh dwellers in Marin County. When the water was ankle deep at high tide, whole flocks were calling, and milling around through the *Salicornia* and *Grindelia*, with dry, brush-covered hillsides only 50 or 75 yards away.

"Courtship of the Sage Grouse" was the subject of a talk by Mr. James Moffitt. He brought out the fact that study of courtship and breeding behavior plays an important part in taxonomy, often revealing relationships more fundamental than those based on plumage differences only. Sexual behavior of the grouse begins early in February in spite of the cold; it is necessary for the young to be brought out during the brief period while the grass is green, as that is the only food of the 2- or 3-day-old chicks. The nuptial display was clearly illustrated by a kodachrome motion picture study, taken by Mr. H. M. Bolland of Eastman Kodak Stores, and shown at the meeting by Mr. Gordon True.

Adjourned.—FRANCES CARTER, *Recording Secretary*.



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